

# TU. 1

# LU. 1

**TRAINING UNIT 1 – I4.0 TECHNOLOGIES**

**LEARNING UNIT 1 – WHAT IS BIONIC TRANSFORMATION**

Your Text Here



## LICENSES

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## FUNDING

This training material has been developed within the framework of the “Fostering digitalisation and bionic transformation of SMEs through the development of a novel and innovative training material for overcoming COVID-19 crisis” (GIST) project.

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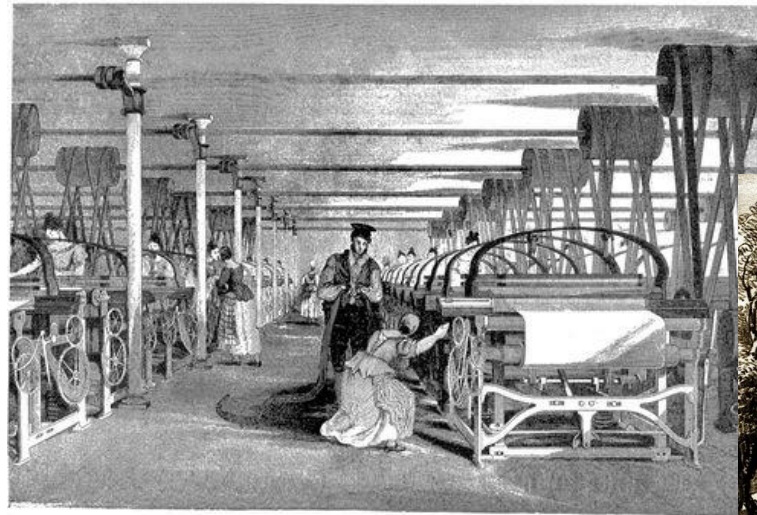


Source: Freepik

# 1. HISTORIC OVERVIEW OF INDUSTRIAL TRANSFORMATION

Throughout human history we can speak of different types of production:

- Pre-industrial production
- Industrial revolution
- Mass production
- Automatization
- Smart production



*Industrial Transformation overview. Source:  
<https://pixabay.com/illustrations/steam-train-locomotive-train-502120/>*



# 1. HISTORIC OVERVIEW OF INDUSTRIAL TRANSFORMATION

## 1.1. PRE-INDUSTRIAL PRODUCTION (INDUSTRY 0.0)

Historically, most households had to produce the good they were using themselves, and only highly skilled crafts were further developed (such as blacksmith, miller, butcher and similar).

This, however, meant that the household had to have access to the resources needed and equipment for production. The production itself was usually small-scale. Although this was not preventing households, if they had surplus to trade it for other goods.

*Example: A family with many sheep could have surplus of wool, while a family living in wetlands might be producing more pottery and they would exchange.*

The production, mostly relayed on a single person making the entire products (from preparation of raw material, to completion of the product). When several people were contributing to the making of the final product, we can say that the production lines was set up and that the product was manufactured. Such manufacturing then lead to surplus of the product and manufacturing becoming part of the economical system.



Pre-industrial production. Source:  
<https://pixabay.com/photos/spinning-wheel-woman-old-fibers-63007/>

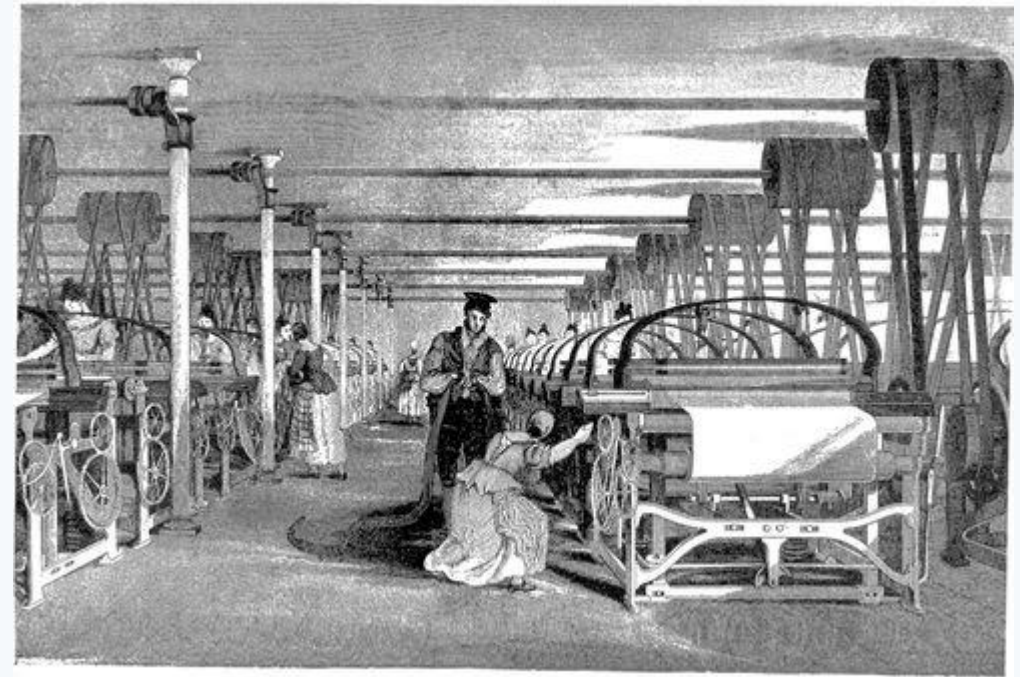
# 1. HISTORIC OVERVIEW OF INDUSTRIAL TRANSFORMATION

## 1.2. INDUSTRIAL REVOLUTION (INDUSTRY 1.0)

The **Industrial Revolution** is the name historians have given to the period in history when there was a large and rapid change in the way things were made. This meant that instead of things being hand made in small workshops, they were made more cheaply in large quantities by machines in factories. Products being made in large quantity now meant that they were sold for less.

Many people began to move from an agricultural based life in the country to the towns where the factories offered more and better paid work.

Following the utilization of steam in industrial process, the production of goods was made on a much larger scale, which had profound impacts on the society itself, as the life of people started changing and instead of more-or-less self sufficient households, people became more dependent on payment for labour in production of large industrial systems, and goods provided by other manufacturers within a developing and growing urban setting.

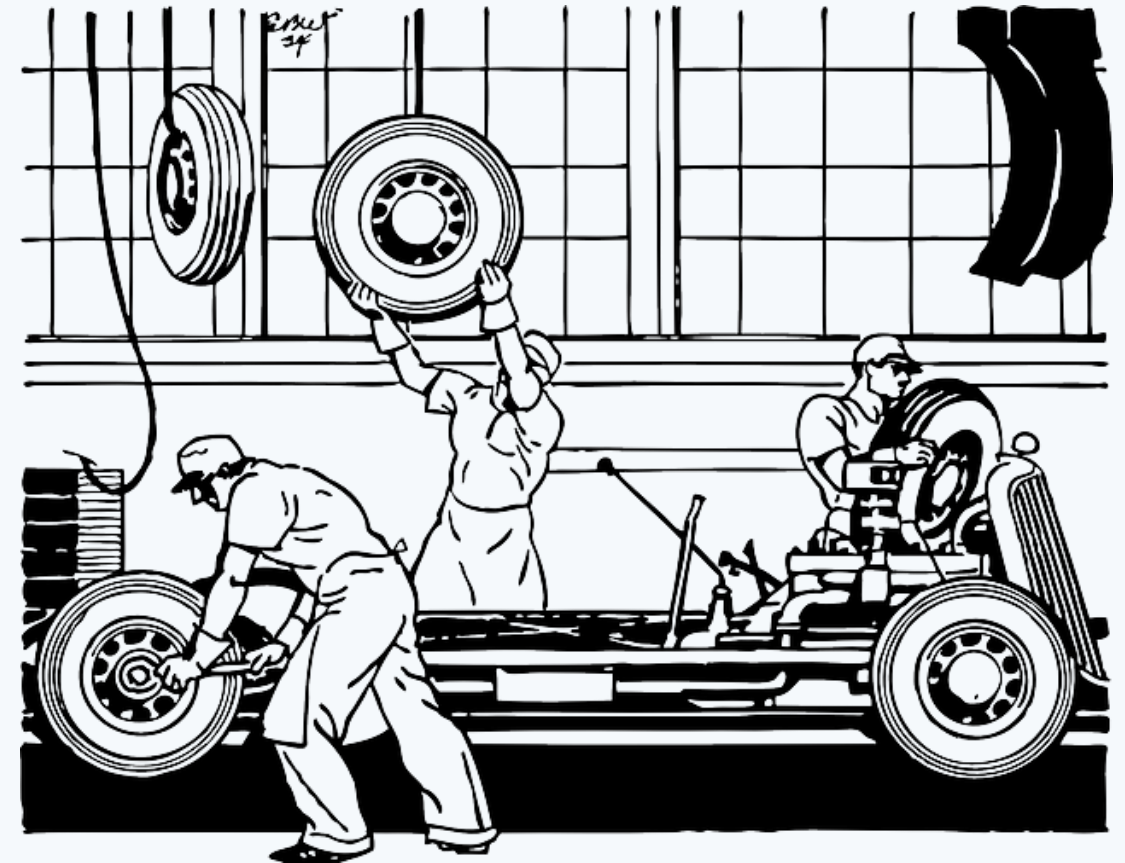


*Industry 1.0. Source: <https://historyforkids.org/wp-content/uploads/2020/12/Industrial-Revolution.jpg>*

# 1. HISTORIC OVERVIEW OF INDUSTRIAL TRANSFORMATION

## 1.3. MASS PRODUCTION (INDUSTRY 2.0)

The 20th century ushered in a change from handcrafting to machine tooling. Henry Ford introduced one of the first moving assembly lines as a way to turn out more cars more quickly, and the emerging auto industry popularized this mode. This new technology, and the spread of industrialization, changed forever the way that work was completed. Automation and mechanization also changed agricultural practices. Mechanized canning changed the way fruit and vegetables were processed and preserved, and made out-of-season produce available year round. As workers adjusted to an increasingly mechanized workplace, good working conditions took on new importance. Workers in several industries formed unions to promote safer working conditions and limit maximum working hours. Such production significantly decreased the cost of the final product, with goods becoming more available for the consumers.



Industry 2.0. Source:  
<https://pixabay.com/illustrations/search/factory%20workers/>



# 1. HISTORIC OVERVIEW OF INDUSTRIAL TRANSFORMATION

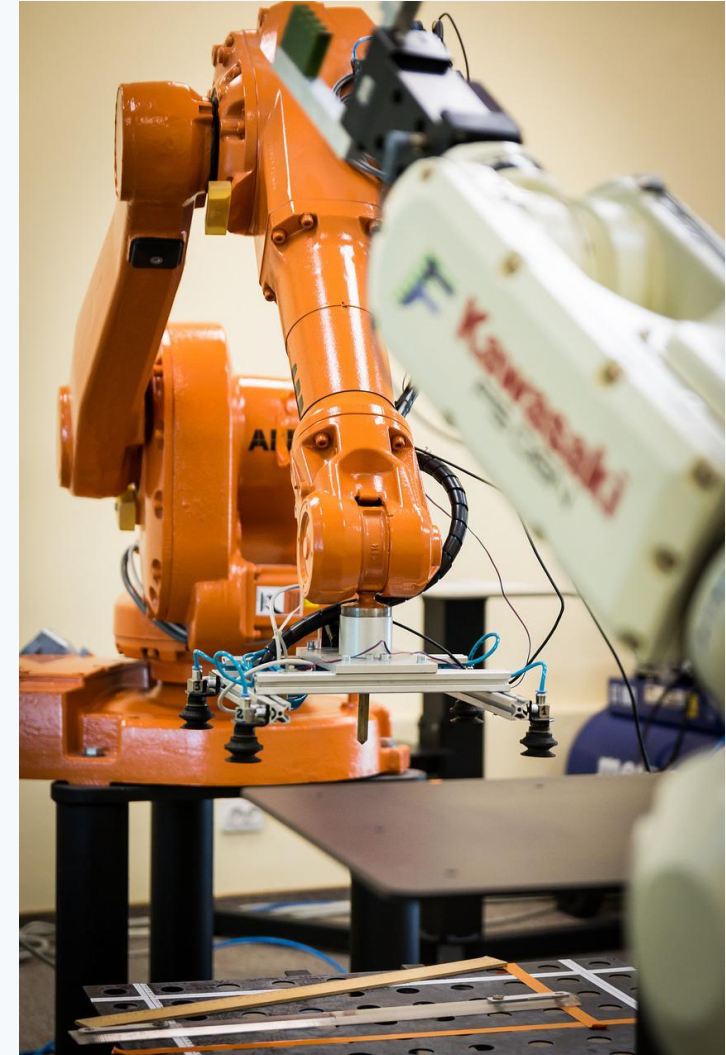
## 1.4. AUTOMATIZATION (INDUSTRY 3.0)

With later development of technology and appearance of informational technology the new wave of industrial transformation took place in the 1970s. The production process became more automatization.

Production lines were no longer fully dependent on the human factor, but included programmed robots for certain work, which, above all, meant more precision and capability of miniaturisation.

Such production especially helped further develop informational technology, which entered all spheres of human lives, as computers became more affordable, smaller, and more capable.

Additionally, the automatization meant the reduction of repetitive working positions for people.



Industry 3.0. Source: <https://pixabay.com/photos/robot-arm-technology-robot-arm-2791677/>



# 1. HISTORIC OVERVIEW OF INDUSTRIAL TRANSFORMATION

## 1.5. SMART PRODUCTION (INDUSTRY 4.0)

The new, smart production, of the Industry 4.0 does not only change the production line, but is part of the entire value chain, as it changes the way the manufacturer is changing their supply, production facilities and even the distribution of products.

With the possibility of fast communication between various digital systems, they can monitor and respond to the need of the productions line.

Example: *Sensor 1 notices that the supply of material A will run out after production of 3 more units. At the same time, computer 1 got 7 more orders, therefore the system realized it needs more material A and will order for a new supply.*

For this purpose the following technologies are introduced, that will be further explained at a latter phase.

This way, the machines themselves are communicating to each other and are performing tasks that were otherwise part of the human factor, overseeing the production lines. This way the surplus is reduced, and the need for production to stock will be reduced and replaced by production on demand (the production starts when the order is received).



Industry 4.0. Source:  
<https://pixabay.com/photos/industry-industry-4-2496192/>

## 2. KEY FACTORS OF BIONIC TRANSFORMATION

The previously mentioned technologies are the 9 key driving factors of bionic transformation, these are:

- Big Data
- Cloud Services
- 3D printing and custom manufacturing
- Internet of Things
- Artificial Intelligence
- Augmented Reality and Virtual Reality
- Robotics
- Blockchain
- Cybersecurity



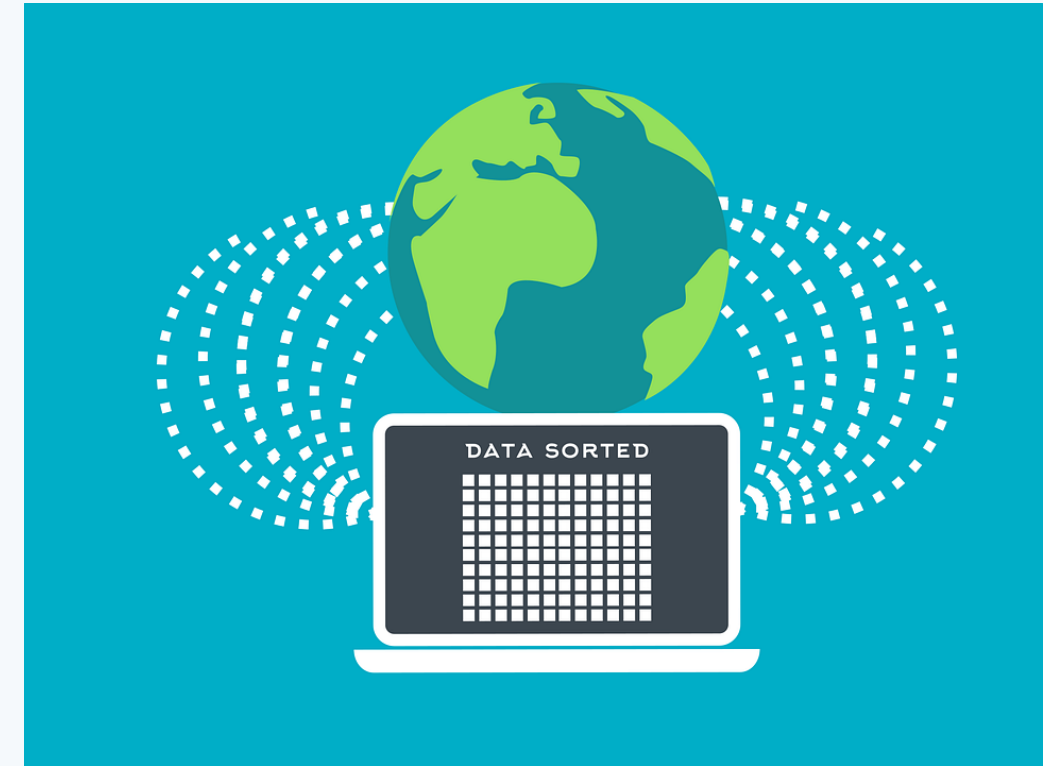
Cloud Computer hosting. Source: <https://pixabay.com/illustrations/cloud-computer-hosting-3406627/>

## 2. KEY FACTORS OF BIONIC TRANSFORMATION

### 2.1. BIG DATA

There is no hard and fast rule about exactly what size a database needs to be for the data inside of it to be considered "big." Instead, what typically defines big data is the need for new techniques and tools to be able to process it. In order to use big data, you need programs that span multiple physical and/or virtual machines working together in concert to process all of the data in a reasonable span of time.

Getting programs on multiple machines to work together in an efficient way so that each program knows which components of the data to process, and then being able to put the results from all the machines together to make sense of a large pool of data, takes special programming techniques. Since it is typically much faster for programs to access data stored locally instead of over a network, the distribution of data across a cluster and how those machines are networked together are also important considerations when thinking about big data problems.



*Big Data. Source: <https://pixabay.com/vectors/data-sorting-classification-report-7042739/>*



## 2. KEY FACTORS OF BIONIC TRANSFORMATION

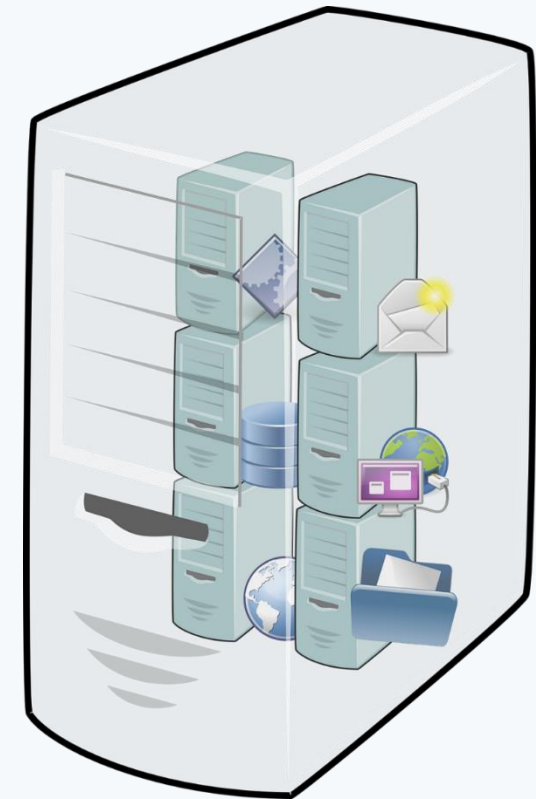
### 2.2. CLOUD SERVICES

When people refer to the cloud, they might be referring to any number of related concepts in computing, but essentially, the cloud is a set of remotely hosted computing resources used by a client, whether a web page, mobile app, or traditional desktop application, for storage and computing power.

The important thing to keep in mind is that the website user interface which you use directly is only a small part of what is going on behind the scenes in any web application. For most tools you use on the Internet, there are many different components that make up the application, from databases to logging tools to data mining and intelligence tools, and anywhere from a few to thousands of pieces of business logic all working together to run the web service.

In order to host all of these applications and the data which they serve, data centres are constructed to house many general purpose server computers, with appropriate amounts of computing power and storage to be shared across many applications.

In many cases, applications are bundled with the operating system and all of the necessary libraries to run the applications into "virtual machines" which can be run on top of the physical machine, independent of the operating system on the host machine itself. This technique, called virtualization, makes applications much more portable, allowing them to run in any environment which can run a virtual machine.



*Cloud computing host server. Source:  
<https://pixabay.com/vectors/cloud-computing-host-server-2023902/>*

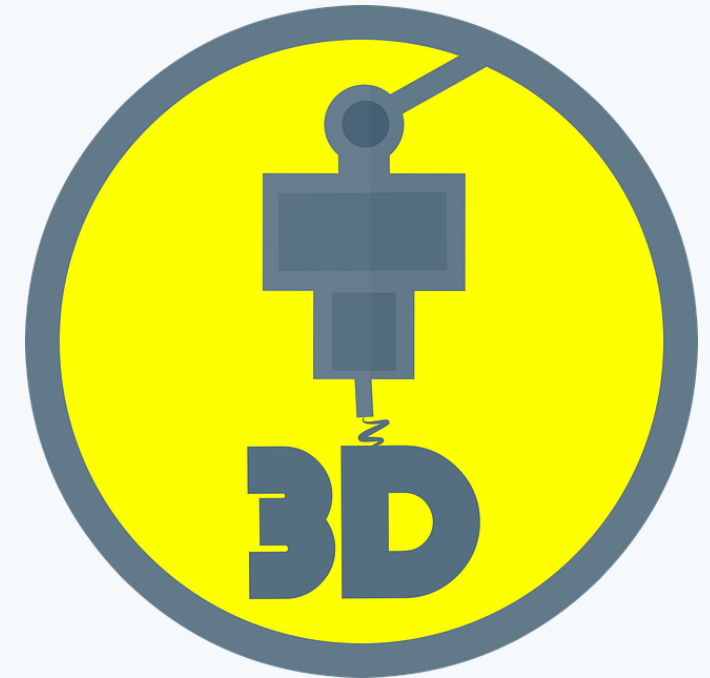
## 2. KEY FACTORS OF BIONIC TRANSFORMATION

### 2.3. 3D PRINTING AND CUSTOM MANUFACTURING

3D printing dates back to 1980, but not to be confused with printing to paper, this innovative technology is formally known as additive manufacturing (AM) within professional circles. Furthermore, this term can be defined as the creation of a solid object by the deposition of material layer by layer until completion. The name “additive” manufacturing was created from the nature of 3D printing, where each successive layer is added to the previous layer.

Today, Computer Aided Design (CAD) models are created to accommodate the designer’s needs and printer’s capabilities along with their manufacturing nuances appropriately. AM provides increased degrees of freedom, permitting designers to create complex and almost alien-like geometric structures. On the macro scale, 3D printing has started to shift how supply chains are to be viewed, by reducing costs, shipping distances, and improving lead times.

Although this technology is by no means new in historical terms, 3D printing has continued to make its way into mainstream industries. As the first decade of the 21st century closed and entered the 2010s, 3D printing technology, and subsequent applications began to increase.



*3D printing extruder. Source:  
<https://pixabay.com/vectors/printer-3d-extruder-computer-3657166/>*

## 2.4. INTERNET OF THINGS

The Internet of Things (IoT) refers to the vast world of interconnected devices with embedded sensors which are capable of providing data, and in some cases, being controlled, across the Internet. Common examples include many home automation devices, like smart thermostats and remotely controllable lighting fixtures, but there are countless others, from traffic sensors to water quality meters to smart electric grid components to tracking manufactured goods and vehicle fleets worldwide.

For a governments or companies, IoT devices are generally focus on collecting data which can be processed and visualized, often in real-time. Some examples include:

- Ability to more accurately forecast energy and water demands.
- Companies and governments can keep track of the current location of everything from vehicle fleets to parts and products.
- Local governments can track real-time parking, transit demand, and even know when garbage cans are reaching capacity.



Internet of things. Source:  
<https://pixabay.com/vectors/network-iot-internet-of-things-782707/>

## 2. KEY FACTORS OF BIONIC TRANSFORMATION

### 2.5. ARTIFICIAL INTELLIGENCE

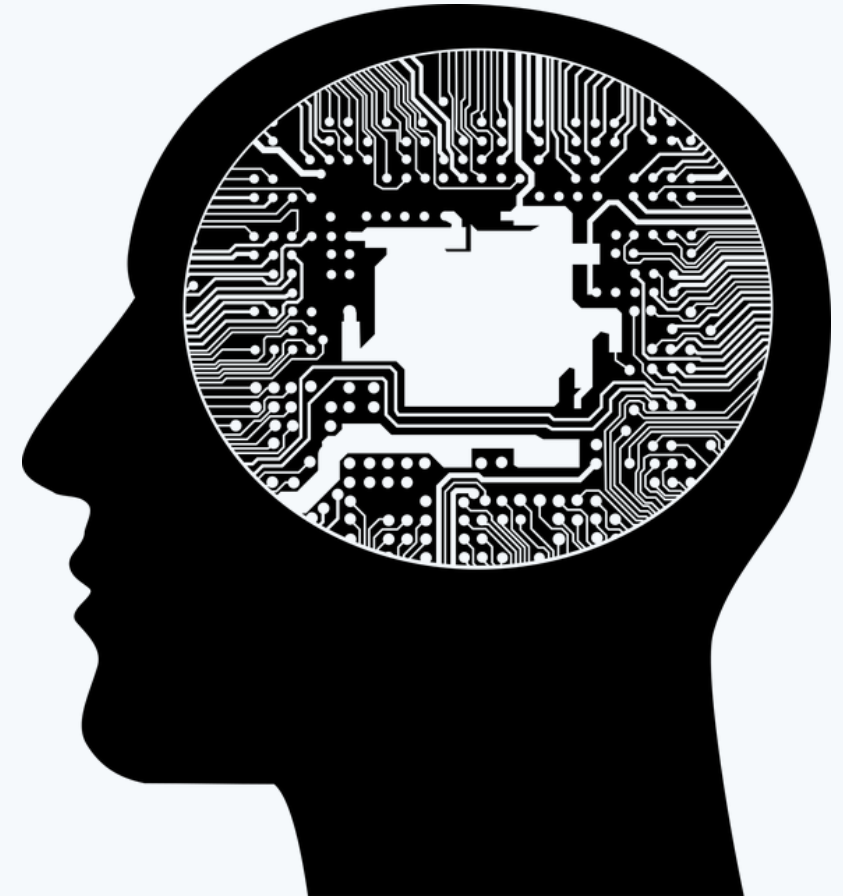
In 1956 an academic discipline of Artificial intelligence was founded. At first it was an action which tried to mimic the human cognitive skills by a machine, whoever, in the 21st century the very definition of what Artificial intelligence is has changed.

Today, one of the most important parts of developing artificial intelligence is the Machine Learning.

Machine learning algorithms create models, based on sample data.

In everyday life we can see these as spam filters in our e-mails, where the filter is trying to block unwanted mail based on the algorithm that learns from our previous behaviour.

Machine learning can be applied to production lines as quality control, as it can detect flaws and also increase productivity, as learning algorithms allow the machine to carry out different tasks the traditional robots (of industry 3.0) could not do.



*Artificial Intelligence. Source:  
<https://pixabay.com/vectors/cranium-head-human-male-man-2099119/>*



## 2. KEY FACTORS OF BIONIC TRANSFORMATION

### 2.6. AUGMENTED REALITY AND VIRTUAL REALITY

The concept of virtual reality is to have a user enter a computer generated environment which emulates reality, where with the help of hardware the user manipulates the virtual world.

*Example: The user is entering a virtual production line, while physically being in a room where the virtual reality hardware is kept. The stimulation presents the working process and malfunctions so the staff can train how to conduct repairs.*

In addition to virtual reality, augmented reality uses elements of the real world around the user, augmenting parts of it with computer generated environment.

*Example: The user is entering a physical location with hardware for augmented reality (such as Google glasses) which produce computer generated images on top of actual objects, so the user enters the actual production line and only the malfunctions are computer generated on top of actual physical equipment.*



Cyber glasses. Source:  
<https://pixabay.com/illustrations/cyber-glasses-cyber-glasses-4689599/>

## 2. KEY FACTORS OF BIONIC TRANSFORMATION

### 2.7. ROBOTICS

As technology, robotics is designing and constructing mechanical hardware that performs specific pre-programmed tasks, or are being remotely controlled and the controller can perform the tasks by a mechanical proxy.

Examples: *A robotic hand can be used in production, to perform a repetitive task requiring strength and precision, thus being more efficient and effective than human labour force.*

*Also, a self moving unit can be used by remote control to enter dangerous spaces, such as mine fields, where the operator can use the mechanical tools to manipulate the dangerous situation from a safe distance.*



Robotics Arm. Source: [https://www.freepik.es/fotos-premium/concepto-fabrica-automatizacion-pantalla-panel-control-brazos-roboticos\\_29446762.htm#query=robot%20industrial&position=7&from\\_view=search](https://www.freepik.es/fotos-premium/concepto-fabrica-automatizacion-pantalla-panel-control-brazos-roboticos_29446762.htm#query=robot%20industrial&position=7&from_view=search)

## 2. KEY FACTORS OF BIONIC TRANSFORMATION

### 2.8. BLOCKCHAIN

Blockchain is a different way of storing data, where each block contains a set of data and once its capacity is full, the data is stored in the next block. The blocks themselves are linked in a chain, thus giving the name blockchain.

Once a block is full with data and linked in the chain, it cannot be changed, thus keeping a permanent record of the activity. This is mostly applied in cryptocurrency.

The main difference between the usual method of storing data in database and blockchain is that with block chain you don't need an entity which is responsible for the security of the database, as blocks are distributed between the different nodes of the computer network. This allows for joint control by the collective of users.



Blockchain. Source:  
<https://pixabay.com/illustrations/blockchain-data-records-concept-4744367/>

## 2. KEY FACTORS OF BIONIC TRANSFORMATION

### 2.9. CYBERSECURITY

With the increase of digitalization, especially in online banking, shopping and other online interaction, the rise of online crimes have also increased.

Cyberattacks are usually aimed at destroying or changing sensitive information, preventing regular operations conducted online, or accessing sensitive data for further manipulation.

For this purpose cybersecurity is crucial, as it is protecting the systems, networks and programmes themselves from such cyberattacks.

On the personal level, each user should understand the security principles of working online – such as backing up sensitive data, be careful with suspicious e-mail attachments, create strong passwords and similar, but also to use quality programmes for providing security (such as anti-virus protection).



Cybersecurity. Source:  
<https://pixabay.com/vectors/cybersecurity-computer-security-6949298/>



## 3. EXAMPLE OF BIONIC COMPANY

### 3.1. A BIONIC COMPANY

A bionic company is the company, where the machines are doing most of the operating process, while humans are designing the processes. This shifts the main focus of human staff in a company from producing a product for the end user, to designing a product for the end user, stressing the importance of interaction between the user and producer.

Further reading: <https://www.bcg.com/publications/2019/bionic-company>



Source: <https://pixabay.com/illustrations/hand-robot-human-machine-face-1571851/>

The Bionic Company



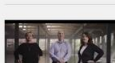
**DigitalBCG | The Bionic Company**

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In the digital age companies must lever new technologies alongside human capabilities to grow. BCG refers to combining the two as a Bionic company. Learn more today <https://www.bcg.com/capabilities/digi...>


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## 3. EXAMPLE OF BIONIC COMPANY

### 3.2. HYPOTHETICAL EXAMPLE

For the purpose of this learning unit we will imagine a hypothetical company “Android Boy” which provides personal transport within cities for delivering parcels or providing mobility for people. The company is providing delivery service for goods and taxi service for people within the city limits.

In the past, the company used a dispatcher system, which meant the dispatcher can only handle one caller at a time, has to check the availability and location of drivers and provide possible feedback information to the user. At the same time, the dispatcher had to collect information about the transport of person or parcel, possibly finding points where the transport will start and end.

The company decided to prepare an application for smart phones, where the user provides the location of pickup and transfer, with the transport appearing to the closest drivers. If confirmed that driver starts the transport, if rejected the transport is suggested to the next closest driver.

The application also allows for the tracing of the driver accepting the transport, so the user can track where the driver is, what route is taken and when the destination point will be arrived (especially for parcel tracking).



Source:

<https://pixabay.com/illustrations/android-logo-logo-coat-of-arms-png-1749407/>

### 3. EXAMPLE OF BIONIC COMPANY

#### 3.2. HYPOTHETICAL EXAMPLE

| Before transformation                               | Transformation    | After transformation                                                                     |
|-----------------------------------------------------|-------------------|------------------------------------------------------------------------------------------|
| Dispatcher taking user calls one at the time        | Setting up an app | User selecting location on app simultaneously                                            |
| Dispatcher communicating with drivers               | Setting up an app | Drivers select who will take over the transport based on their location and availability |
| Dispatcher providing feedback information for users | Setting up an app | User receiving direct feedback in real time (tracking parcel, observing mobility).       |



Source:  
<https://pixabay.com/illustrations/android-logo-logo-coat-of-arms-png-1749407/>

## 3. EXAMPLE OF BIONIC COMPANY



### 3.2. HYPOTHETICAL EXAMPLE

#### How was the company transformed to become bionic?

The core business of the company was providing transport within the city, however, the interaction between the users and providers of the core service was done through a dispatcher system that was responsible for collecting orders and distributing tasks, occasionally also providing information (which was an additional task of the dispatcher taking up more of the time).

By introduction of the online application for ordering transports, the user directly showed the route of the transport (pick up and delivery location), and the application could easily determine which free driver was closest to the location and could therefore take over the transport, reducing costs.

Furthermore, the application allowed for tracing of the driver that started the transport, thus providing better user experience, as they knew where the parcel was, in case of delivery of goods, not just transport of people.

Most importantly, however, the application was based on artificial intelligence, that could determine which driver will be closest to the position of next pick up, based on their current location or the destination of their transport, thus optimising the pick up and delivery system and reducing fuel costs and impact on the environment.

Finally, the app allowed for multiple users to input their location simultaneously, while the dispatch service was busy while communicating with a customer and with several dispatchers the communication between dispatchers and drivers was at points confusing.



## 3. EXAMPLE OF BIONIC COMPANY

### 3.2. HYPOTHETICAL EXAMPLE

#### What were the barriers on the way to becoming a Bionic Company?

The barriers for Android Boy to set up their app driven model of operating were both internal and external:

##### Internal barriers

- Staff not wanting to transform
- Staff fearing change and job loss (dispatchers)
- Management lacking knowledge to decide on software needed

##### External barriers

- Lack of city wide coverage for fast internet
- Lack of real time data about roadworks and similar
- Refusal of people using online apps for transports

Once the first two external barriers were eliminated and the city was fully covered with fast internet and the real time data about traffic, detours and other relevant traffic information was provided, the users were automatically starting to use online apps, and it was not a problem anymore to also use transport apps. However, the company could not influence these changes.

On the other hand, the company could manage their internal barriers, but had more difficulties connected to them. First the management had to raise their own capacity for digital transformation, to be able to prepare a suitable strategy for transformation and to find suitable digital tools to enable the change. However, the company didn't just have to set up a strategy for digital development, it also had to communicate it with the employees, explaining the benefits of transformation and also present the strategy of retraining the dispatcher staff to customer support, showing there will be no loss of employment. Once the barriers were overcome, the company digitalized and started expanding.



Source:

<https://pixabay.com/vectors/impossible-possible-attitude-6890980/>

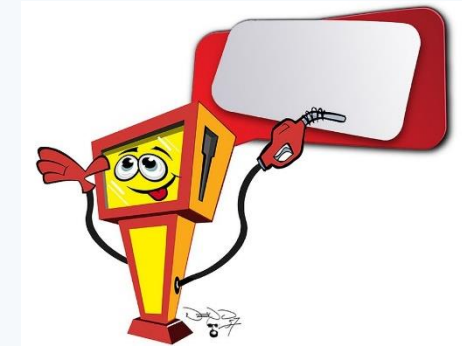
## 3. EXAMPLE OF BIONIC COMPANY

### 3.2. HYPOTHETICAL EXAMPLE

#### What are the benefits of being a Bionic Company?

In the case of Android Boy the benefits were:

- Faster response time of drivers → more transports → more revenue
- Better overview and tracking of transports → higher efficiency
- Lowered fuel consumption → lower costs → lower impact on environment
- Better user experience for people looking for transport → more transports → more revenue
- Possibility of online payment, in addition to cash/card payment → better user experience → more transports → more revenue
- Dispatchers becoming customer support → implementing user suggestion for improvements → better user experience → more revenue



Source: <https://pixabay.com/illustrations/cartoon-petrol-gas-pump-gas-station-1813761/>



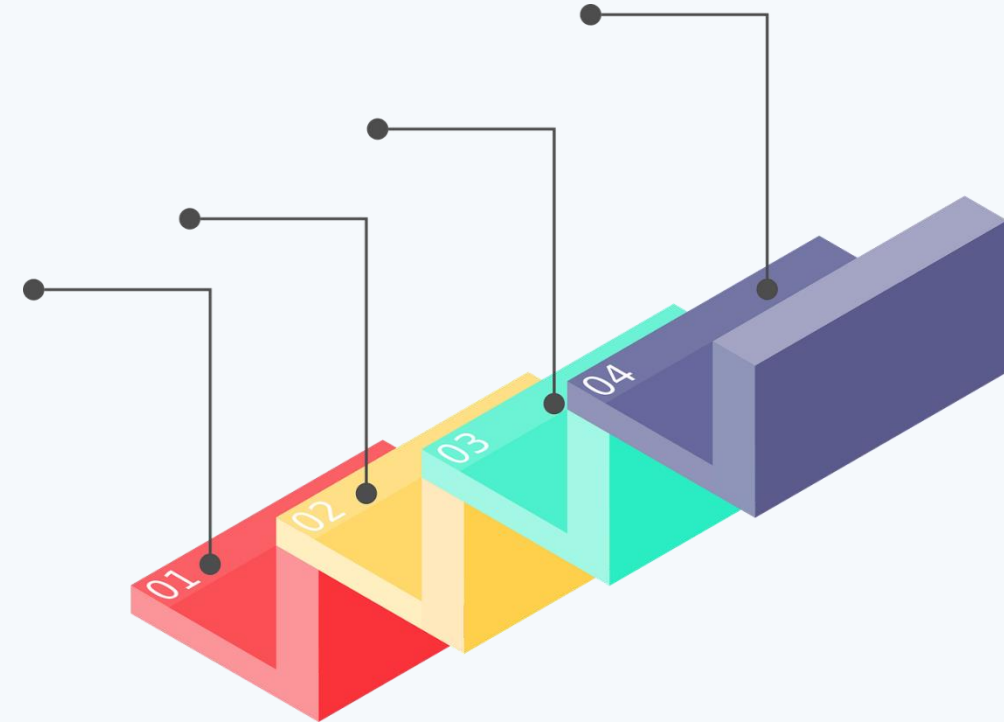
Source: <https://pixabay.com/illustrations/customer-experience-best-excellent-3024488/>

## 3. EXAMPLE OF BIONIC COMPANY

### 3.3. STRATEGY FOR BIONIC TRANSFORMATION

As seen from the hypothetical case, the strategy for digital transformation was the key component that the company needed. Therefore a good strategy for transforming a company must include the following considerations:

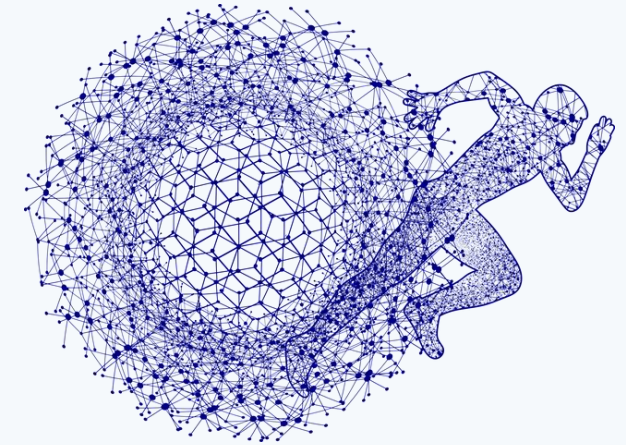
- Challenges: what are the challenges that the company is facing, prepare a SWAT (or similar) analysis
- Management: consider the capacity of management to lead the process of change, hire suitable consultants if needed
- Staff: consider the capacity of staff to uptake the changes, consider the fears of the staff connected to change and job security, allow for retraining on the job, communicate with the staff openly
- Technology: consider the technological solutions that could best address the challenges of your company and possible barriers for the uptake of the new technology used
- Barriers: consider other possible internal or external barriers to the transformation and set an action plan for transformation accordingly.



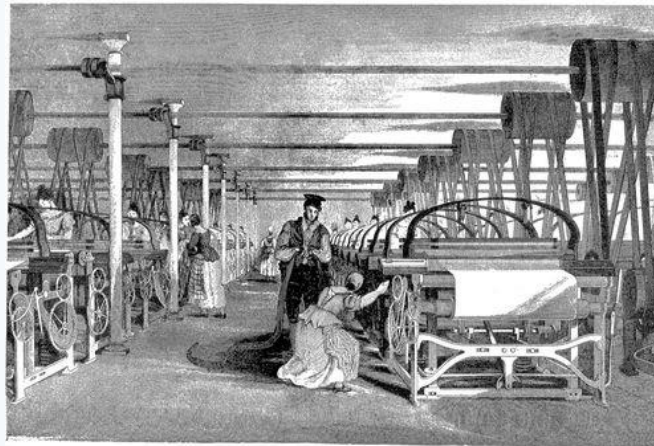
Source: <https://pixabay.com/vectors/infographic-staircase-progress-step-2895154/>

## 4. FOOD FOR THOUGHT

- What is bionic transformational of a company?
- Which technologies can contribute to bionic transformation?
- Do you have the basic understanding, what each of the technologies mean?
- What plays the crucial role in preparation for bionic transformation?
- How does the role of employees change after bionic transformation?
- Think of a company you are familiar with, and envision, how it could change into a bionic company.



Source: <https://pixabay.com/vectors/network-earth-blockchain-globe-7057559/>



Source: <https://historyforkids.org/wp-content/uploads/2020/12/Industrial-Revolution.jpg>



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<https://calisphere.org/UCLA/collections/>

<https://www.quora.com/>

Kiddle Encyclopedia. Industrial Revolution facts for kids. Source: <https://kids.kiddle.co/>



# Fostering diGitalisation and blonic transformation of SMEs through the development of a novel and innovative Training material for overcoming COVID-19 crisis

[HTTPS://GIST-PROJECT.EU/](https://gist-project.eu/)



**Thank  
you**

# TU. 1

# LU. 2

**TRAINING UNIT 1 – I4.0 TECHNOLOGIES**

**LEARNING UNIT 2 – TECHNOLOGICAL DRIVERS OF BIONIC TRANSFORMATION**

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# TABLE OF CONTENT

Within the learning unit the participant of the training will gain the basic overview of the following 9 technologies that were included into the key study survey of the GIST project, especially the 5 that were identified as key technologies.

## 1. Big Data

- 1.1. What is big data?
- 1.2. What kind of datasets are considered big data?
- 1.3. How is big data analyzed?
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## 9. Cybersecurity

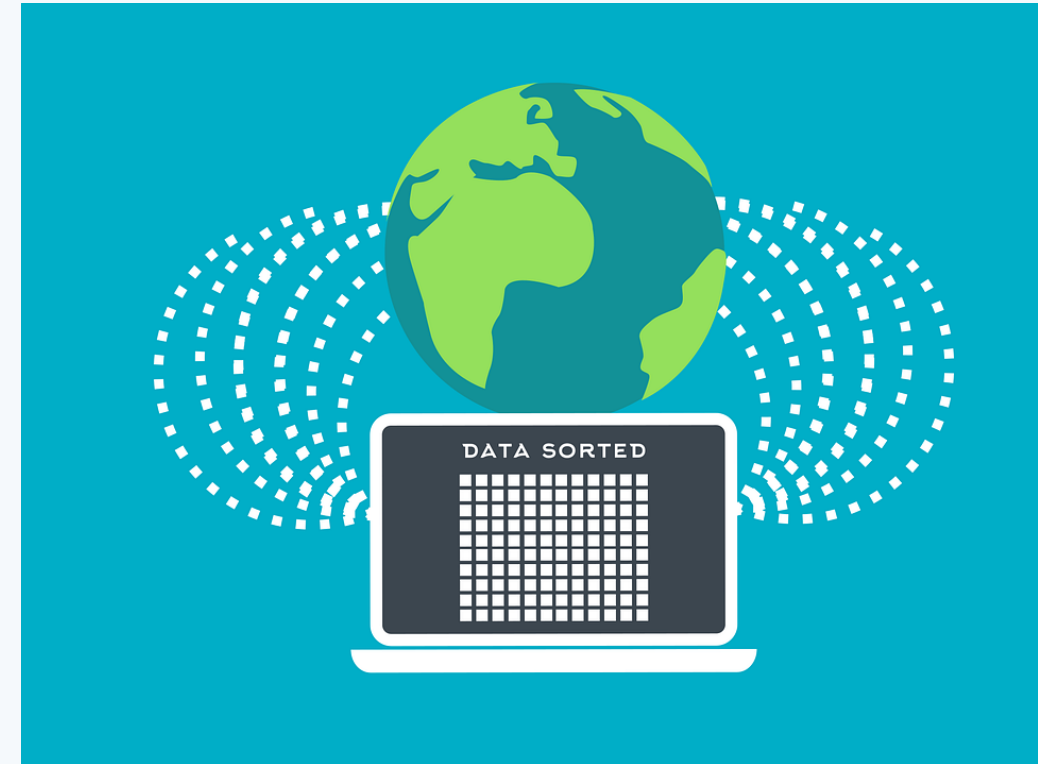


Cloud computer hosting. Source:  
<https://pixabay.com/illustrations/cloud-computer-hosting-3406627/>

# 1. BIG DATA

Everyone seems to be talking about Big Data, but what it is really? How is it changing the way researchers at companies, non-profits, governments, institutions, and other organizations are learning about the world around them? Where is this data coming from, how is it being processed, and how are the results being used? And why is open source so important to answering these questions?

- **What is big data?**
- **What kind of datasets are considered big data?**
- **How is big data analyzed?**
- **What tools are used to analyze big data?**



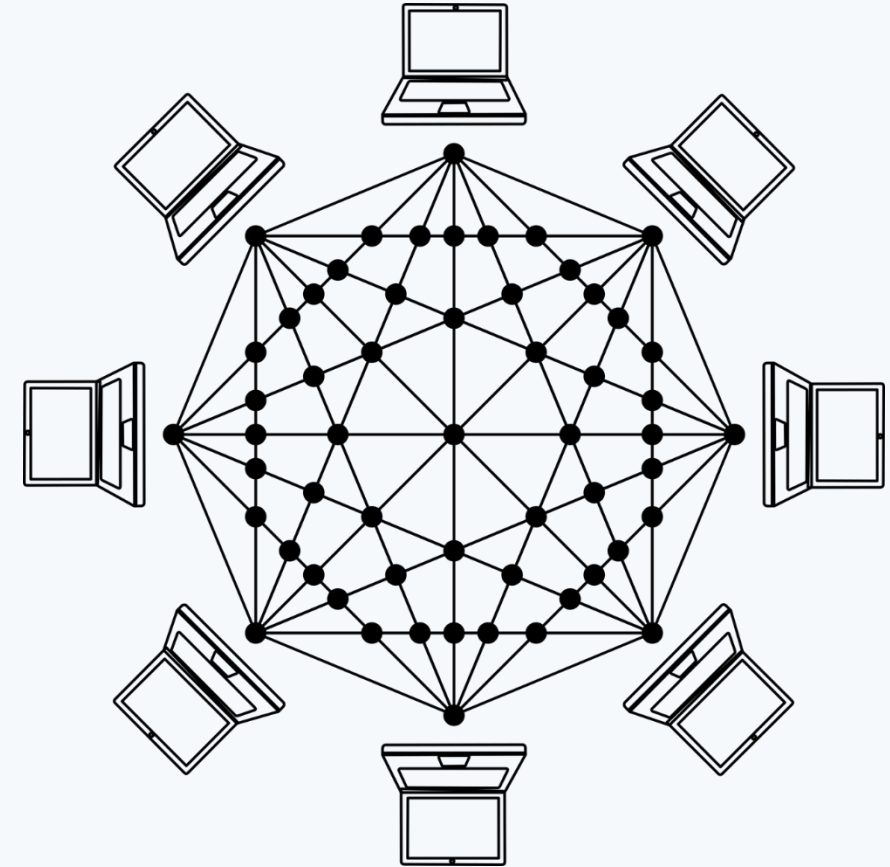
*Big Data. Source: <https://pixabay.com/vectors/data-sorting-classification-report-7042739/>*



## 1.1. WHAT IS BIG DATA?

There is no hard and fast rule about exactly what size a database needs to be for the data inside of it to be considered "big." Instead, what typically defines big data is the need for new techniques and tools to be able to process it. In order to use big data, you need programs that span multiple physical and/or virtual machines working together in concert to process all of the data in a reasonable span of time.

Getting programs on multiple machines to work together in an efficient way so that each program knows which components of the data to process, and then being able to put the results from all the machines together to make sense of a large pool of data, takes special programming techniques. Since it is typically much faster for programs to access data stored locally instead of over a network, the distribution of data across a cluster and how those machines are networked together are also important considerations when thinking about big data problems.



*Telecommunication network. Source:  
<https://pixabay.com/vectors/telecommunications-network-3717684/>*

## 1.2. WHAT KIND OF DATASETS ARE CONSIDERED BIG DATA?

The uses of big data are almost as varied as they are large. Prominent examples you're probably already familiar with include: social media networks analyzing their members' data to learn more about them and connect them with content and advertising relevant to their interests, or search engines looking at the relationship between queries and results to give better answers to users' questions.

But the potential uses go much further! Two of the largest sources of data in large quantities are transactional data, including everything from stock prices to bank data to individual merchants' purchase histories; and sensor data, much of it coming from what is commonly referred to as the Internet of Things (IoT). This sensor data might be anything from measurements taken from robots on an automaker's manufacturing line, to location data on a cellphone network, to instantaneous electrical usage data in homes and businesses, to passenger boarding information taken on a transit system.

By analyzing this data, organizations can learn trends about the data they are measuring, as well as the people generating this data. The hope for this big data analysis is to provide more customized service and increased efficiencies in whatever industry the data is collected from.



Network. Source: <https://pixabay.com/vectors/network-iot-internet-of-things-782707/>

## 1.3. HOW IS BIG DATA ANALYZED?

One of the best-known methods for turning raw data into useful information is what is known as MapReduce. MapReduce is a method for taking a large data set and performing computations on it across multiple computers, in parallel. It serves as a model for how to program and is often used to refer to the actual implementation of this model.

In essence, MapReduce consists of two parts. The Map function does sorting and filtering, taking data and placing it inside of categories so that it can be analysed. The Reduce function provides a summary of this data by combining it all together. While largely credited to research that took place at Google, MapReduce is now a generic term and refers to a general model used by many technologies.

Perhaps the most influential and established tool for analysing big data is known as Apache Hadoop. Apache Hadoop is a framework for storing and processing data at a large scale, and it is completely open source. Hadoop can run on commodity hardware, making it easy to use with an existing data centre, or even to conduct analysis in the cloud.



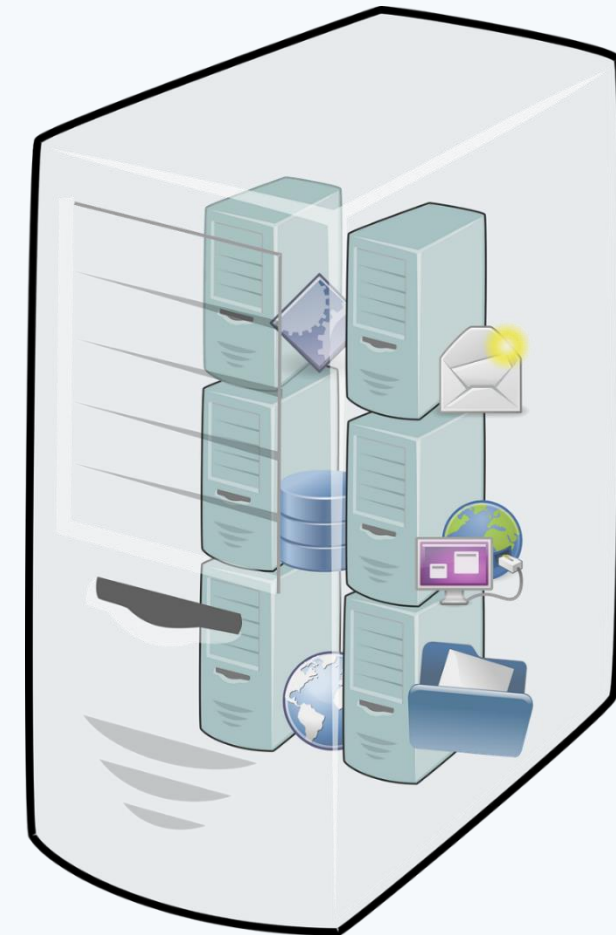
*Big Data. Source:*  
<https://pixabay.com/illustrations/big-data-database-analysis-3338320/>

## 2. CLOUD SERVICES

Everybody's talking about the cloud, but what it is really, and what does it have to do with software licensing?

When people refer to the cloud, they might be referring to any number of related concepts in computing, but essentially, the cloud is a set of remotely hosted computing resources used by a client, whether a web page, mobile app, or traditional desktop application, for storage and computing power.

The line between cloud computing and the traditional client/server computing model can be a little fuzzy, but in general, cloud computing is often differentiated by scale, and by the design principle that computing resources in the cloud are generally more flexible and multi-purpose than in traditional server computing, able to be used for whatever need is most in demand.



Cloud computing host server. Source:  
<https://pixabay.com/vectors/cloud-computing-host-server-2023902/>

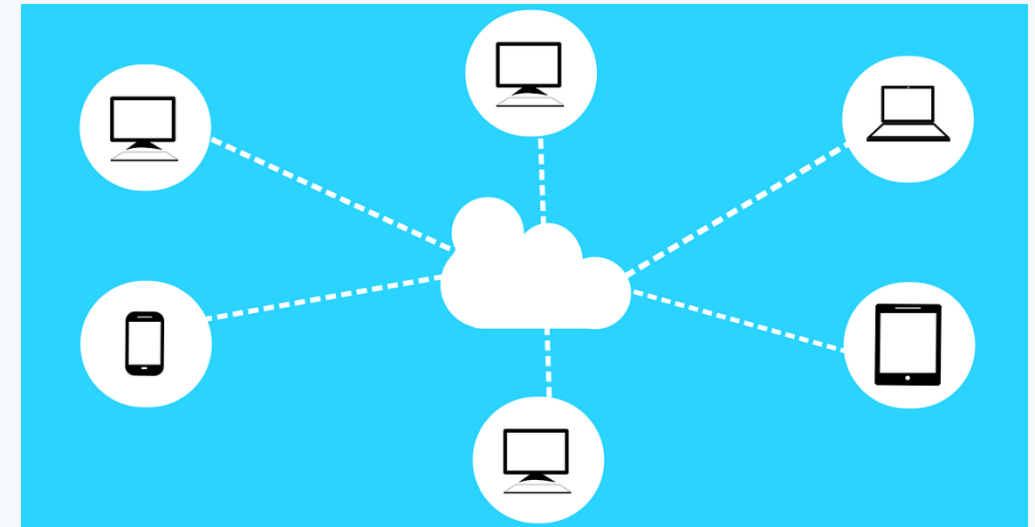
## 2. CLOUD SERVICES

### 2.1. EXAMPLES OF CLOUDS

For average users, the "cloud" is the presentation of the end services. It could be a social media platform, an e-commerce store, a music streaming service, an airline ticketing site, a file storage service, or something totally different.

The important thing to keep in mind is that the website user interface which you use directly is only a small part of what is going on behind the scenes in any web application. For most tools you use on the Internet, there are many different components that make up the application, from databases to logging tools to data mining and intelligence tools, and anywhere from a few to thousands of pieces of business logic all working together to run the web service.

Each of these pieces lives on a computer somewhere, and more often than not, the place where these components live is the cloud.



*Cloud computing cloud system. Source:  
<https://pixabay.com/illustrations/cloud-computing-cloud-system-cloud-2153286/>*

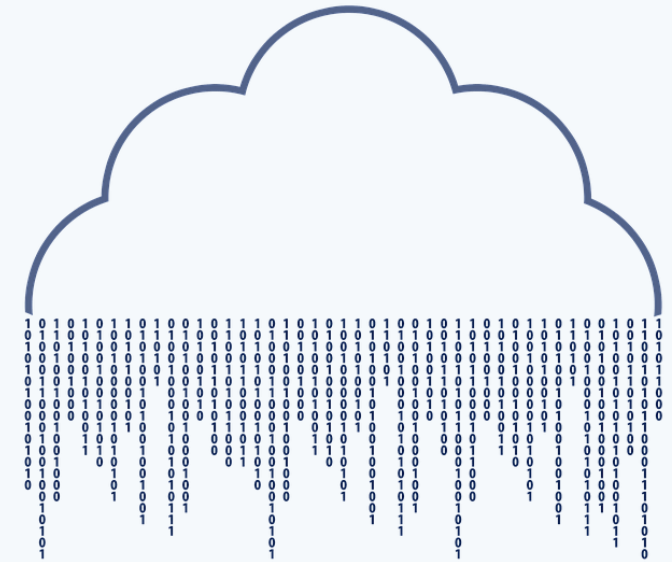


### 2.2. HOW DOES A CLOUD WORK?

In order to host all of these applications and the data which they serve, data centres are constructed to house many general purpose server computers, with appropriate amounts of computing power and storage to be shared across many applications.

In many cases, applications are bundled with the operating system and all of the necessary libraries to run the applications into "virtual machines" which can be run on top of the physical machine, independent of the operating system on the host machine itself. This technique, called virtualization, makes applications much more portable, allowing them to run in any environment which can run a virtual machine.

When an application is designed to expand and contract according to demand, utilizing more virtual machines when demand is higher and fewer when demand is lower is called elastic computing, or simply, the elastic cloud. Storage can be pooled together similarly, allowing applications to use hard drives attached to many different physical machines as if it were a single resource, minimizing waste while making it easy to develop applications which require quite large amounts of data.



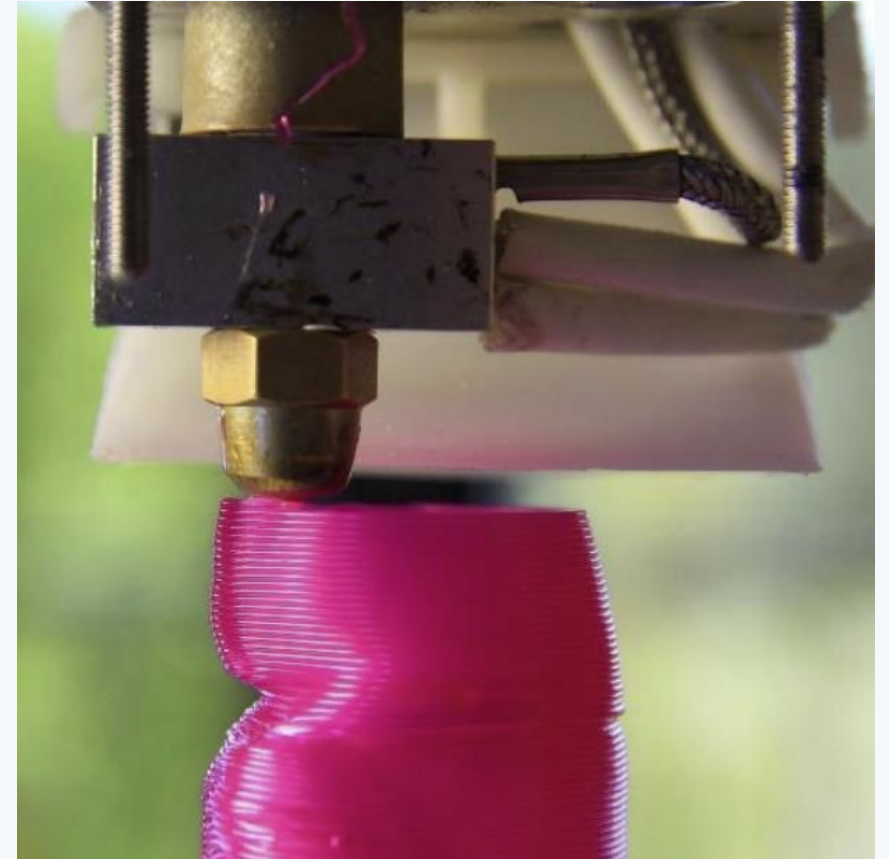
Cloud storage. Source:  
<https://pixabay.com/illustrations/cloud-storage-storage-medium-3805852/>

### 3. 3D PRINTING AND CUSTOM MANUFACTURING

The world of 3D printing can be met with confusion, misguided assumptions, and general misunderstandings, such as “Where does the paper go?” or “How much does ink cost?”.

For this reason, this innovative technology is formally known as additive manufacturing (AM) within professional circles. Furthermore, this term can be defined as the creation of a solid object by the deposition of material layer by layer until completion. The name “additive” manufacturing was created from the nature of 3D printing, where each successive layer is added to the previous layer.

Alternately, the method of subtractive manufacturing (SM), utilizes machining systems like Computer Numerically Controlled (CNC) machining centres to remove material from a bulk component usually made of metal.



3D printing. Source:  
[https://oercommons.s3.amazonaws.com/media/courseware/relatedresource/file/Chapter\\_1\\_Introduction\\_-\\_1-27-21\\_qhGe56K.pdf](https://oercommons.s3.amazonaws.com/media/courseware/relatedresource/file/Chapter_1_Introduction_-_1-27-21_qhGe56K.pdf)

### 3. 3D PRINTING AND CUSTOM MANUFACTURING

Along with the introduction of any disruptive technology, such as computers, the internet, or smartphones; individuals must be willing to change their methods and procedures as these inventions change the world around them.

One such immediate change which accompanies 3D printing is how products are designed. A few decades ago, the standard for new product design was still a clay model used to portray the approximate geometry to be used in the product. Today, Computer Aided Design (CAD) models are created to accommodate the designer's needs and printer's capabilities along with their manufacturing nuances appropriately.

However, just as important as the machine itself, the software driving the 3D printer plays an integral role in the quality, structure, and efficiency of each successive build. This software is known as the slicer, as it effectively slices the designated model into numerous layers for printing.



3D printing machine. Source:  
[https://oercommons.s3.amazonaws.com/media/courseware/relatedresource/file/Chapter\\_1\\_Introduction\\_-\\_1-27-21\\_qhGe56K.pdf](https://oercommons.s3.amazonaws.com/media/courseware/relatedresource/file/Chapter_1_Introduction_-_1-27-21_qhGe56K.pdf)

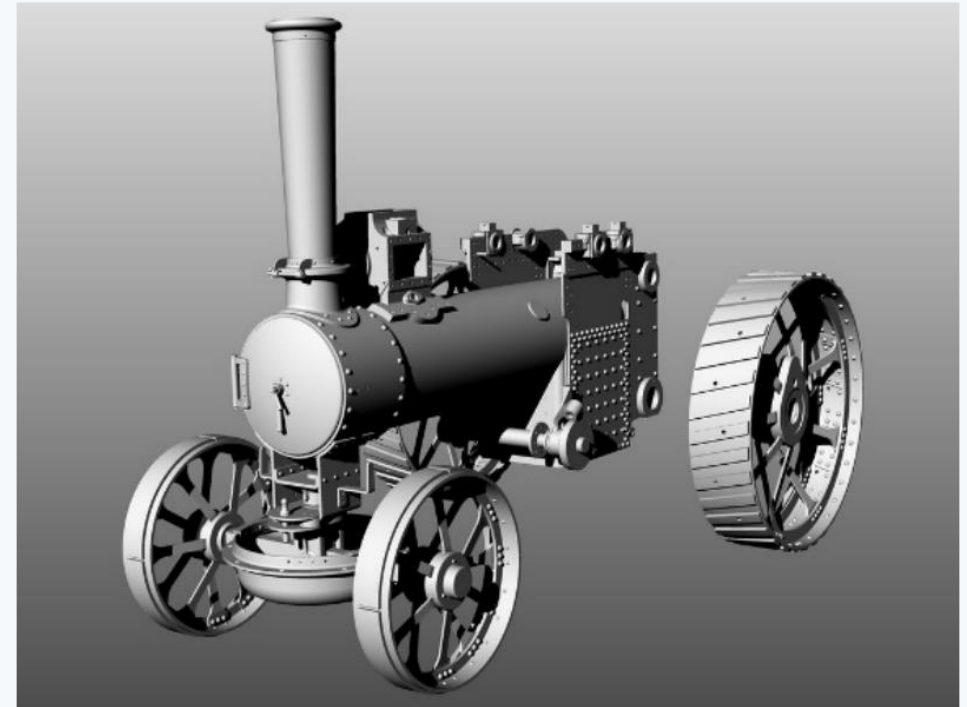
## 3. 3D PRINTING AND CUSTOM MANUFACTURING

### 3.1. COMPUTER AIDED DESIGN

Computer-aided design (CAD) can be defined as a specialized software which allows the user to design and/or simulate an object. By this definition, CAD is one of the primary tools used in any engineering field which seeks to design a physical object. Aside from portraying the shape and size of a 3D rendering, a CAD program may also be used to define material, surface finish, and even the process in that will be used for manufacture.

Computer-aided design can also include, but not be limited to, animating a moving part, assembling parts, or even testing the model virtually to ensure the proper physical properties; thereby reducing the cost and development time for complex engineered systems.

CAD programs falling within this category would include SolidWorks, Siemens NX, Autodesk Inventor, and Creo among others.



CAD. Source:  
[https://oercommons.s3.amazonaws.com/media/courseware/relatedresource/file/Chapter\\_2\\_Final\\_Presentations1-30-21\\_3UbpmGF.pdf](https://oercommons.s3.amazonaws.com/media/courseware/relatedresource/file/Chapter_2_Final_Presentations1-30-21_3UbpmGF.pdf)

## 3. 3D PRINTING AND CUSTOM MANUFACTURING

### 3.2. APPLICATIONS OF ADDITIVE MANUFACTURING

Additive manufacturing continues to find new applications within a wide range of industries:

Rapid Prototyping - the first use of 3D Printing technology was for a process known as rapid prototyping.

Low Volume Production Runs - not all products can be mass produced in this fashion. Instead, there are applications which require only a small batch of parts at irregular intervals or must have a specialized product.

Mass Customization - a simplistic example of this type of customization is a tailor who creates suits and dresses for their customers. Due to the fact that in the 3D printing process, there are no significant reconfigurations necessary between two different prints, all that is required is a new STL file and a simple change of the material being used.



*Application of 3DP. Source:  
[https://oercommons.s3.amazonaws.com/media/courseware/relatedresource/file/Chapter\\_4\\_All-In-One\\_2-11-21.pdf](https://oercommons.s3.amazonaws.com/media/courseware/relatedresource/file/Chapter_4_All-In-One_2-11-21.pdf)*



## 3. 3D PRINTING AND CUSTOM MANUFACTURING

### 3.3. 3D PRINTING TECHNOLOGIES

There are 7 types of additive manufacturing:

- 1) Vat Photopolymerization: use of an ultraviolet light to cure photosensitive resin from a basin known as the vat.
- 2) Material Jetting: moving print head ejects hundreds of tiny resin droplets onto the build platform where it is cured by an ultraviolet lamp.
- 3) Binder Jetting: deposits an adhesive onto a bed of powder to bond the grains together thereby creating a solid layer.
- 4) Material Extrusion: process in which material is heated to its glass transition temperature and forced through a nozzle using back pressure, and is systematically placed on the build plate.
- 5) Powder Bed Fusion: methodology which uses lasers, heat, or electron beams to melt and sinter these granulated particles into a three-dimensional object
- 6) Sheet Lamination: uses traditional printer paper for the layers and an adhesive to bond them together into a three-dimensional model.
- 7) Directed Energy Deposition: technique that uses a laser to melt powdered or wire-form material as it is ejected from a nozzle mounted on a multi-axis arm, which moves to build the layers.

## 4. INTERNET OF THINGS

For individuals, there are numerous consumer devices which work out-of-the-box. Many of these devices fall into the broad category of home automation. Some examples include:

- Indoor and outdoor lighting and electrical outlets which can be controlled by sensors, timers, and remote applications.
- Thermostats and other devices to alter your indoor climate based on knowing where you are, outside temperature conditions, and what your energy savings goals are.
- Cameras, motion sensors, automatic locks, and other access control devices which can be integrated into advanced security and monitoring systems.
- Water leak sensors, smoke alarms, carbon monoxide sensors, and other devices designed to protect people and property from accidental harm.
- Appliances like washers, dryers, refrigerators, and more which have special functions and can alert you to their status remotely.
- Electric car chargers, battery banks, and other devices which can intelligently charge at off-peak hours to save money and reduce peak energy demands.

There are other devices too, from wearable heart rate sensors to baby monitors to sleep sensors, which are designed to help you with daily tasks or help you to keep track of vital (or not-so-vital) information. Devices like automobiles are also increasingly in many ways themselves a sensor network, tracking dozens of types of information about their performance and safety, as well as providing new features and entertainment options.



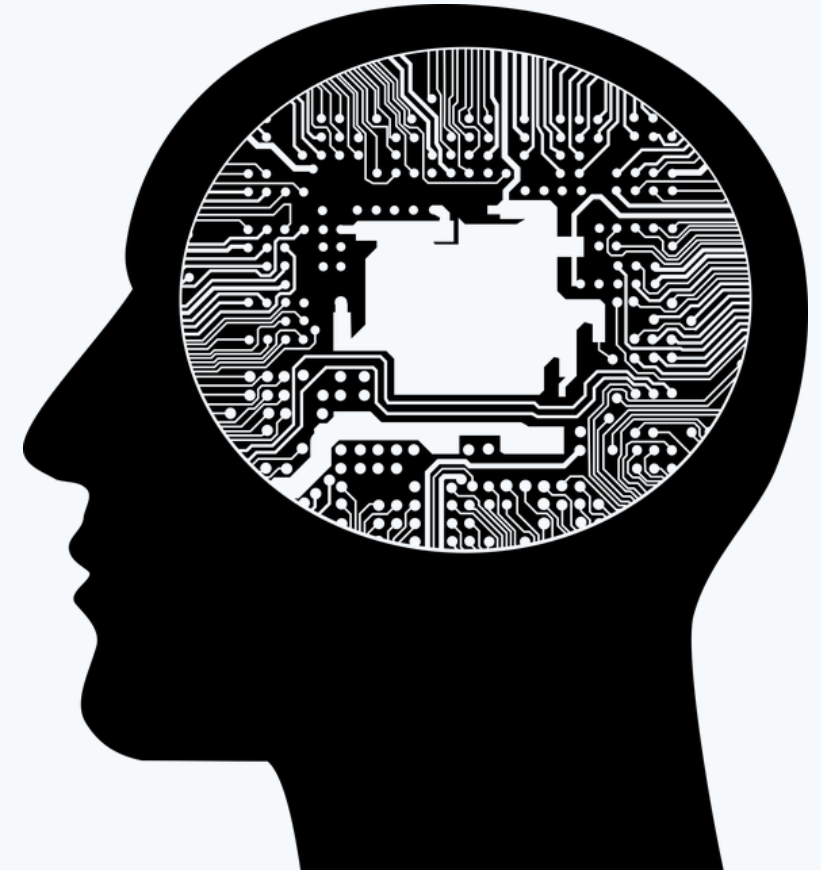
*Communication internet. Source:  
<https://pixabay.com/illustrations/communication-internet-1927697/>*

## 5. ARTIFICIAL INTELLIGENCE

There are two definitions of artificial intelligence:

- *The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.*
- *The capacity of a computer to perform operations analogous to learning and decision making in humans, as by an expert system, a program for CAD or CAM, or a program for the perception and recognition of shapes in computer vision systems.*

Artificial intelligence (AI) is predicted to have a significant impact on society and business. Examples include, autonomous cars, computers understanding human speech and machine learning. Consider for instance, that computer chess games available for commercial desktop machines have the ability to beat accomplished chess players including grand masters.



Artificial Intelligence. Source:  
<https://pixabay.com/vectors/cranium-head-human-male-man-2099119/>

## 6. AUGMENTED REALITY AND VIRTUAL REALITY

### What is Virtual Reality?

Virtual Reality (VR) is an immersive experience of a computer-generated world. The user's perspective changes as they move their head. Virtual Reality experiences include both non-interactive and interactive experiences.



*VR glasses. Source: Freepik*

### What is Augmented reality?

Augmented Reality (AR) is non-immersive. It is a digital overlay imposed over the real world. No headset is required for AR. Instead, AR is viewed using smartphones or tablets. Computer-generated images appear to be inserted into the real world by using the device's camera. They might float in mid-air or be "fixed" to a nearby surface so that the user can view multiple sides of 3D objects.



*AR. Source: Freepik*

## 6. AUGMENTED REALITY AND VIRTUAL REALITY

### 6.1. VIRTUAL REALITY

In practice, there are two ways to experience VR: using a desktop computer or tablet, or by using a headset, also known as a Head-Mounted Display (HMD). And then, there are two kinds of HMD: dedicated VR headsets with built-in displays, and inexpensive plastic or cardboard headsets that hold a smartphone.

While using a desktop or tablet isn't exactly "immersive," it's often the easiest and lowest-cost method to begin experiencing VR. It also may be more accessible and usable for people with disabilities, and those that wear glasses. Many HMDs are not usable with glasses. If users are wearing HMDs, they should remain seated to avoid risk of falling. Rolling chairs are great for experiencing VR because they allow movement.



Head-Mounted Display (HMD). Source: Freepik



Computer generated 360 view of an office. Source: Freepik



## 6. AUGMENTED REALITY AND VIRTUAL REALITY

### 6.2. AUGMENTED REALITY

AR has an advantage over virtual reality in that it doesn't require special hardware besides the mobile device itself. However, older devices may not be able to run AR, and most AR experiences require downloading an app. Whether a tablet or a phone is used, the device must be equipped with the software to support AR experiences.

There are a few methods to activate an AR experience. Users might manually launch an app to explore AR on their own (marker-less), or they might use physical markers to launch AR experiences (marker-based). AR experiences can also be triggered by the user's physical location (location-based).

**Google Expeditions** provides both AR and VR experiences. There is a wealth of AR experiences available via the app that allows users to view objects in 3D. Users can pin the 3D objects to their own physical space, and they may resize and view the objects from all angles.



*Google Expeditions. Source: <https://www.eduporium.com/blog/google-expeditions-app-alternatives-in-education/>*

## 6. AUGMENTED REALITY AND VIRTUAL REALITY

### 6.2. AUGMENTED REALITY

The **MERGE Cube** is a physical foam square with a unique marker on each face, which allows the cube to become a 3D computer-generated object in AR.



MERGE CUBE. Source: <http://www.oercommons.org/courses/get-started-with-augmented-and-virtual-reality-for-learning/view>



CLEVER BOOKS. Source:

<https://play.google.com/store/apps/details?id=eu.cleverbooks.cbgeography&hl=sl&gl=US>

**Clever Books** provides work-sheets that double as AR markers to launch interactive experiences. The resulting AR experience is an interactive view of the continent.

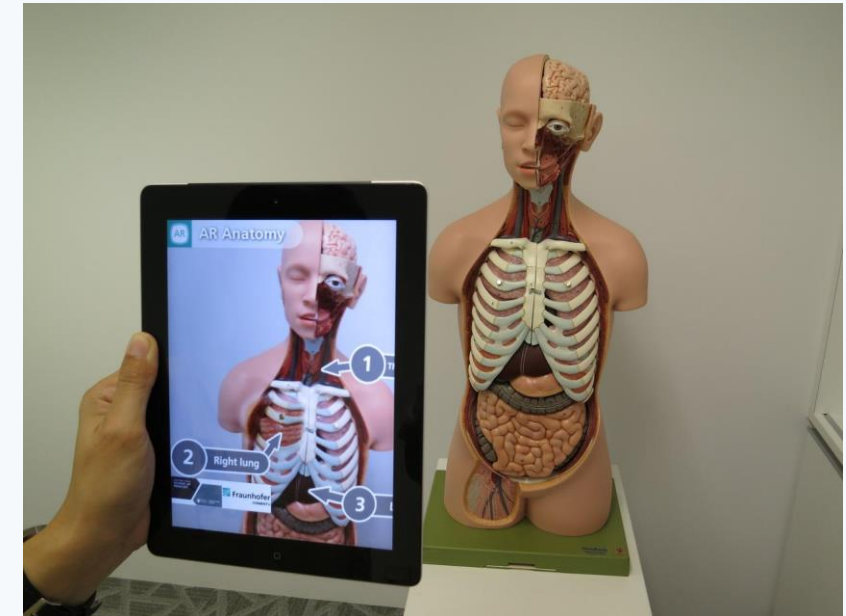
## 6. AUGMENTED REALITY AND VIRTUAL REALITY

### 6.3. CONSIDERATIONS FOR USING AR AND VR

Augmented and virtual reality are an excellent complement and extension of experiencing real life processes. But it's important to prep your users in advance for the experience to make it effective as a learning opportunity.

Here are some guidelines for using AR and VR:

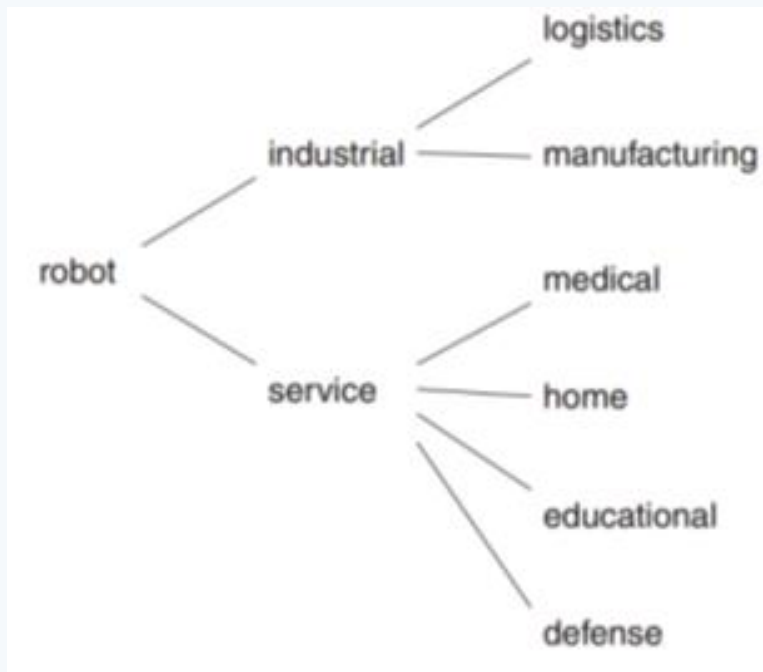
- Provide context before diving into an AR or VR experience.  
e.g. have basic knowledge of the topic presented.
- Engage with an area of focus.
- Communicate expectations for using the materials
- After the AR or VR experience, ask users to further interact with the concept.



Augmented reality application. Source:  
<https://pixabay.com/photos/augmented-reality-medical-3d-1957411/>

## 7. ROBOTICS

Although everyone seems to know what a robot is, it is hard to give a precise definition. The Oxford English Dictionary gives the following definition: *“A machine capable of carrying out a complex series of actions automatically, especially one programmable by a computer.”*



Classification of robots. Source: Mordechai Ben-Ari and Francesco Mondada, “Elements of Robotics,” Open Educational Resource (OER) - Unsyiah Library, accessed June 7, 2022, <http://www.uilis.unsyiah.ac.id/oer/items/show/379>.



Robot. Source.  
<https://www.oercommons.org/courses/what-is-a-robot-2/view>

### 7.1. TYPES OF ROBOTS

Robots can be classified according to the environment in which they operate. The most common distinction is between **fixed** and **mobile** robots. These two types of robots have very different working environments and therefore require very different capabilities.

- **Fixed robots** are mostly industrial robotic manipulators that work in well defined environments adapted for robots. Industrial robots perform specific repetitive tasks such soldering or painting parts in car manufacturing plants.
- **Mobile robots** are expected to move around and perform tasks in large, ill-defined and uncertain environments that are not designed specifically for robots. They need to deal with situations that are not precisely known in advance and that change over time. Such environments can include unpredictable entities like humans and animals. Examples of mobile robots are robotic vacuum cleaners and self-driving cars.

There is no clear dividing line between the tasks carried out by fixed robots and mobile robots—humans may interact with industrial robots and mobile robots can be constrained to move on tracks—but it is convenient to consider the two classes as fundamentally different. In particular, fixed robots are attached to a stable mount on the ground, so they can compute their position based on their internal state, while mobile robots need to rely on their perception of the environment in order to compute their location.



Robot arm. Source:  
<https://pixabay.com/photos/a-book-robot-dice-simulation-3010727/>

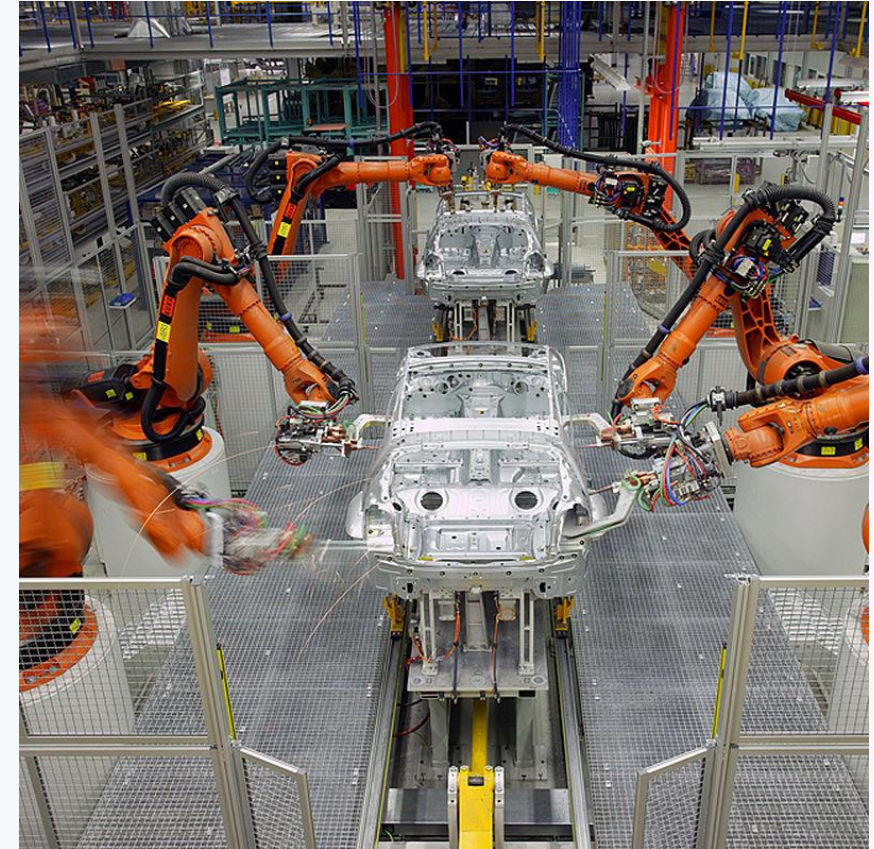


## 7. ROBOTICS

### 7.2. INDUSTRIAL ROBOTS

The first robots were industrial robots which replaced human workers performing simple repetitive tasks. Factory assembly lines can operate without the presence of humans, in a well-defined environment where the robot has to perform tasks in a specified order, acting on objects precisely placed in front of it.

One could argue that these are really automata and not robots. However, today's automata often rely on sensors to the extent that they can be considered as robots. However, their design is simplified because they work in a customized environment which humans are not allowed to access while the robot is working. However, today's robots need more flexibility, for example, the ability to manipulate objects in different orientations or to recognize different objects that need to be packaged in the right order. The robot can be required to transport goods to and from warehouses. This brings additional autonomy, but the basic characteristic remains: the environment is more-or-less constrained and can be adapted to the robot.



*Robots on an assembly line in a car factory. Source: [https://commons.wikimedia.org/wiki/Category:Automobile\\_assembly\\_lines#/media/File:Application\\_field\\_automotive.jpg](https://commons.wikimedia.org/wiki/Category:Automobile_assembly_lines#/media/File:Application_field_automotive.jpg)*

### 7.3. AUTONOMOUS MOBILE ROBOTS

Many mobile robots are remotely controlled, performing tasks such as pipe inspection, aerial photography and bomb disposal that rely on an operator controlling the device. These robots are not autonomous; they use their sensors to give their operator remote access to dangerous, distant or inaccessible places. Some of them can be semi-autonomous, performing subtasks automatically. The autopilot of a drone stabilizes the flight while the human chooses the flight path. A robot in a pipe can control its movement inside the pipe while the human searches for defects that need to be repaired. Fully autonomous mobile robots do not rely on an operator, but instead they make decisions on their own and perform tasks, such as transporting material while navigating in uncertain terrain (walls and doors within buildings, intersections on streets) and in a constantly changing environment (people walking around, cars moving on the streets).



*Autonomous mobile robot weeding a field. Source: Ecorobotix*

## 8. BLOCKCHAIN

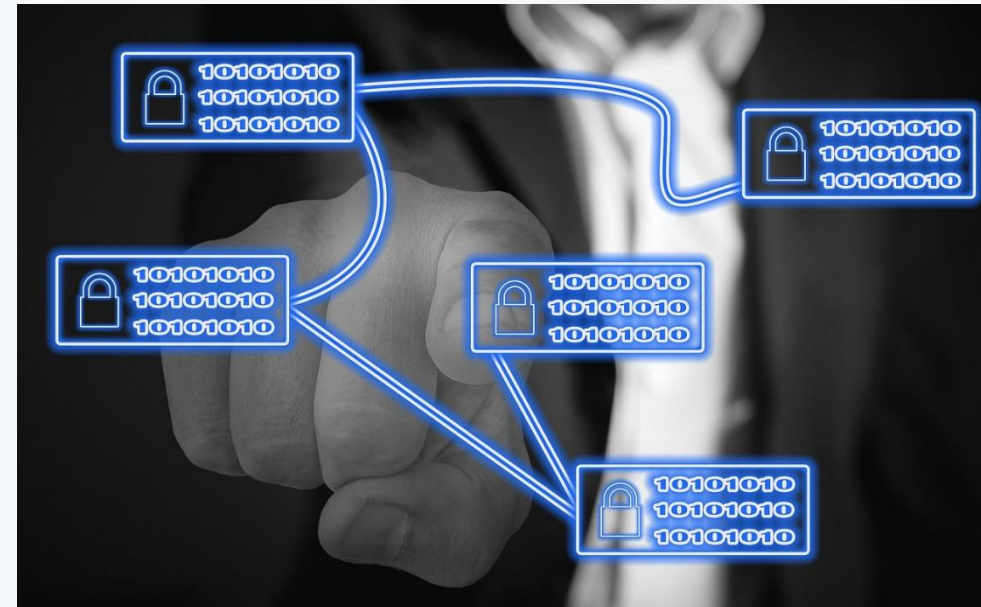
Blockchain in past few years have received a keen interest because of its characteristics as an irreversible and tamper-proof public records repository for documents, education resources, contracts, properties, and assets.

Many use Bitcoin as a beginning stage, clarifying blockchain innovation by its first application, digital currency, as there is no formal definition yet.

ISO has described blockchain as a common, changeless record that can record exchanges crosswise over various ventures. It is an advanced stage that records and checks exchanges straightforwardly and securely, expelling the need for agents and expanding trust through its profoundly straightforward nature.

IBM proposes a comparative definition saying that a blockchain is a common, changeless record for account the history of exchanges.

So, we can say, that blockchain is a set of data blocks, linking in a chain, to store information that cannot be changed after the block is full, with every user also storing a part of the data in the chain.



*Blockchain. Source:  
<https://pixabay.com/illustrations/blockchain-data-records-concept-4744367/>*



## 9. CYBERSECURITY

Cybersecurity refers to the body of technologies, processes, methodologies, and practices designed to protect digital assets including networks, devices, applications, systems, and data from attack, damage, or unauthorized access.

Put more simply, cybersecurity is all about protecting CIA:

- Confidentiality: do not share personal data of users,
- Integrity: prevent deletion or modification of data from unauthorized parties,
- Availability: information and resources are available to those who need them.



Cybersecurity. Source:  
<https://pixabay.com/vectors/cybersecurity-computer-security-6949298/>

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- <https://pixabay.com/>



# Fostering diGitalisation and blonic transformation of SMEs through the development of a novel and innovative Training material for overcoming COVID-19 crisis

[HTTPS://GIST-PROJECT.EU/](https://gist-project.eu/)



**Thank  
you**

# TU.1

# LU.3

**TRAINING UNIT 1 – I4.0 TECHNOLOGIES**

**LEARNING UNIT 3 – 3DP AND CUSTOM MANUFACTURING.**



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## 1. Introduction to additive manufacturing

### 1.1. How does additive manufacturing work?

### 1.2. What is Rapid Prototyping?

### 1.3. Technologies

## 2. Additive manufacturing main technologies

### 2.1. Fused Deposition Modelling (FDM)

- Process
- Strengths and weaknesses
- Application areas

### 2.2. Stereolithography (SLA)

- Process
- Strengths and weaknesses
- Application areas

### 2.3. Selective Laser Sintering (SLS)

- Process
- Strengths and weaknesses
- Application areas

## 3. Production process for 3D printing with FDM

### 3.1. Obtaining the digital model

### 3.2. Exporting, testing and repairing the STL file

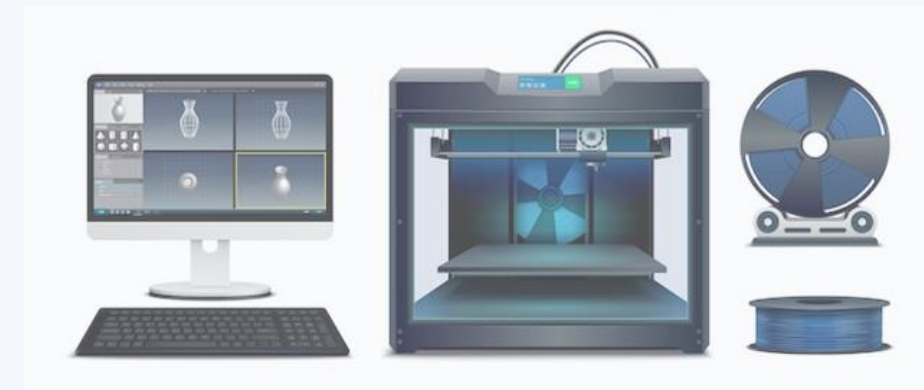
### 3.3. Obtaining the G-CODE

### 3.4. 3D printing

### 3.5. Extracting pieces

### 3.6. Post-processing

## 4. Conclusions



3DP system. Source: Freepik

# 1. INTRODUCTION TO ADDITIVE MANUFACTURING

## 1.1. HOW DOES ADDITIVE MANUFACTURING WORK?

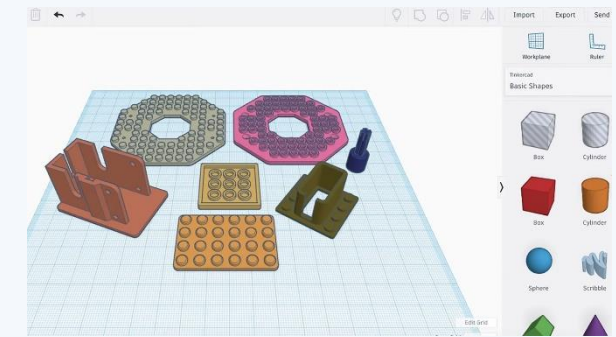
The term “additive manufacturing” references technologies that grow three-dimensional objects one layer at a time. Each successive layer bonds to the preceding layer of the object. Objects are digitally defined by a digital design. These are the principles all AM technologies work with. So, there are different 3D printing or AM technologies and materials that are possible to print with, but all are based on the same principle: a digital model is turned into a solid three-dimensional physical object by adding material layer by layer.

It all starts with making or obtaining somehow a virtual design of the model or object to be created. It can be created using some CAD (Computer Aided Design) software, for creating a totally new object, or using reverse engineering, to copy and modify some existing object, or even it is possible to obtain the model in an online repository.

The 3D printing process turns an object into many tiny slices (layers), building it from the bottom up, slice by slice. The layers are built up to form a solid object.



*Additive Manufacturing. Source: [OpenLearn](#)*



*CAD Software. Source: [All3DP](#)*



# 1. INTRODUCTION TO ADDITIVE MANUFACTURING

## 1.2. WHAT IS RAPID PROTOTYPING?

Rapid prototyping is any process that quickly builds physical prototypes from 3D CAD files, composed of surface quality or solid models. It is important not to confuse rapid prototyping with 3D printing or with additive manufacturing, because the concepts are interchangeable and used wrongly many times. We can say that additive manufacturing is one of the technologies with which we can produce a rapid prototyping product.

Some of the most common techniques for rapid prototyping are:

- Additive manufacturing
- CNC machining
- Vacuum fast casting
- Prototype molds
- Sand casting
- Investment casting
- Etc.



*CNC machining. Source: CETEM.*

The main purpose of rapid prototyping is to test the various design features, ideas, concepts, functionality, output and performance.

# 1. INTRODUCTION TO ADDITIVE MANUFACTURING

## 1.2. WHAT IS RAPID PROTOTYPING?

Custom manufacturing, in the manufacturing and prototyping world, is the opposite to mass-produced stock items.

Modern manufacturing theory, tools, and best practices are focused on how to make thousands or millions of identical parts or products at a low cost per unit. Design and manufacturing practices that optimize for high volume production allow companies to deliver goods at prices acceptable to consumers while providing manufacturers with small profit margins per unit, that become significant when multiplied across a full manufacturing run.

Custom or small series parts and products such as bespoke jewelry, specialty electronics, and medical or dental appliances tailored to one's body pose unique challenges that require manufacturers to adapt production processes.

So, custom manufacturing is defined by the agility and ability to design, engineer and manufacture unique products that are meant to fit specific functions or requirements. Unlike mass-produced products, custom-made products are often produced in smaller quantities on a made-to-order basis.

High precision additive manufacturing processes are ideal for custom production, as they offer high flexibility, minimal setup, toolless fabrication processes, and can produce parts in a wide range of geometries and materials, to respond to shifting needs.

# 1. INTRODUCTION TO ADDITIVE MANUFACTURING

## 1.3. TECHNOLOGIES

Therefore, there are a lot of different additive manufacturing technologies. All of them work under the very same principles already explained and can be classified according to the physical fundament they use to produce the 3D object. So, we can find different classifications, but here we will divide them into:

- **Deposition:** It is the best known of all the categories, probably because it is the cheapest and the easiest to use. The technology that belongs to this group is Fused Deposition Modeling (FDM). It is also known as Fused Filament Fabrication (FFF). It is based on a hot extruder that deposits molten plastic in layers, thus creating the three-dimensional object.
- **Photopolymerization:** In this group of technologies, objects are created by the action of an ultraviolet beam or a CO2 (or a different one) laser, which strikes a plastic liquid that is sensitive to this type of light, and which hardens. For example: stereolithography (SLA).
- **Sintering:** The basic principle that governs this group is the compaction of a powder at a certain temperature, either by means of a laser, or by an electron beam, among other contributions of energy. Ex: Selective Laser Sintering (SLS).

# 1. INTRODUCTION TO ADDITIVE MANUFACTURING

## 1.3. TECHNOLOGIES

- **Injection:** Technologies included in this category or group are based on a binding agent that is injected to bind the particles of the material used together. PolyJet technology is an example.
- **Lamination:** In this group, the pieces are manufactured by superimposing sheets of paper, PVC, etc., in which the geometry of the corresponding layer is successively cut out. Glue and heat are often used to bond the layers together. This group of technologies is in disuse. Example: manufacture of laminated objects (LOM).

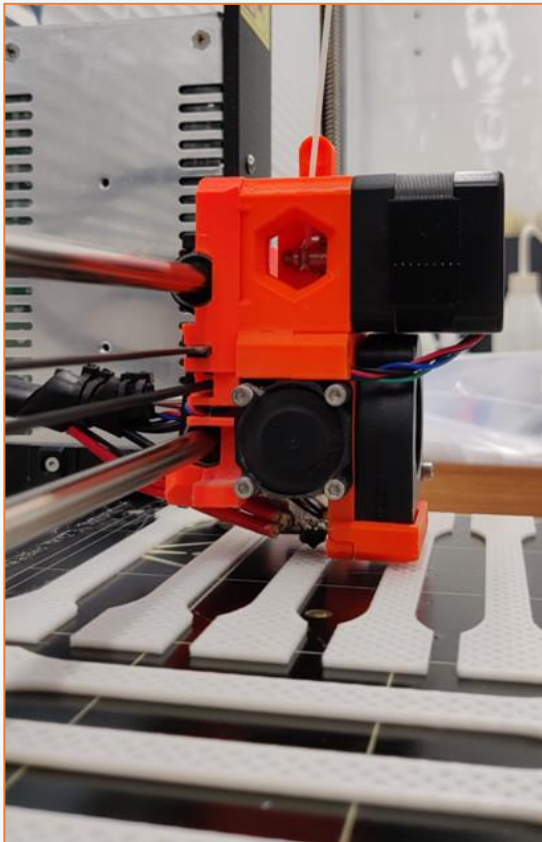
It is possible to find some other classifications, for 3D printing or additive manufacturing technologies, like:

- Material extrusion
- VAT Polymerization
- Powder Bed Fusion
- Material Jetting
- Binder Jetting
- Direct Energy Deposition

## 2. ADDITIVE MANUFACTURING MAIN TECHNOLOGIES

### 2.1. FUSED DEPOSITION MODELLING (FDM)

#### PROCESS:



*FDM machine. Source: CETEM*

The technology works by extruding a thermoplastic polymer through a heated nozzle which gets deposited on a building bed or platform.

The mere process involves a plastic filament which is fed by a spool to the nozzle where the material is liquefied and “drawn” on the platform or bed surface. As soon as it touches the build platform, the filament hardens while being gradually deposited, following a certain structure, in order to create the final 3D print.

When a layer is finally drawn, the platform lowers the layer thickness so that the printing head can start working on the next layer.

Some 3D printers have a different configuration, and the bed platform cannot move. It is the printing head of the element that gives the 3 movements in the space: x, y and z.

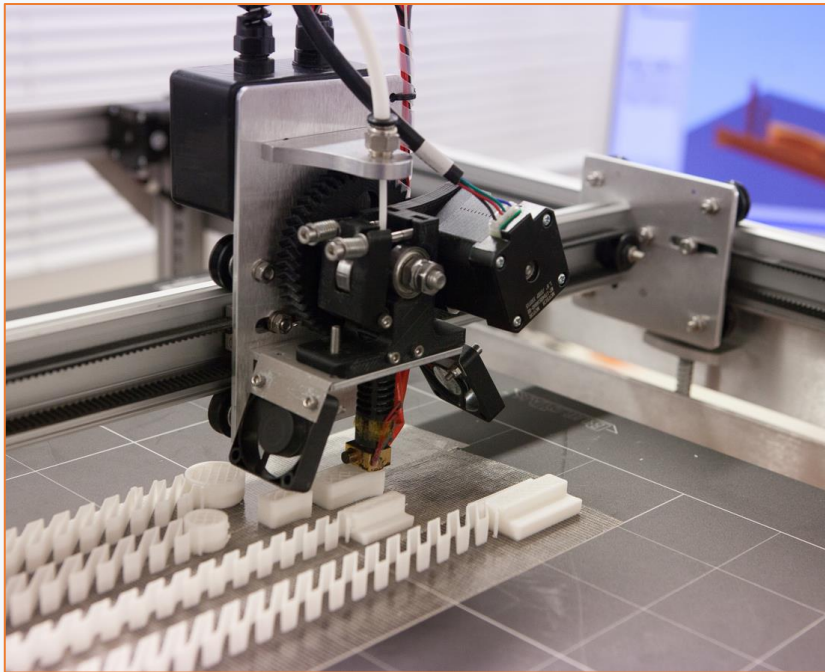
The FDM printer nozzle is heated to the required temperature for the used material so that the filament is melted. The filament slowly advances into the nozzle thanks to the drive wheels and pullers that pull it into the heated part of the extruder.



## 2. ADDITIVE MANUFACTURING MAIN TECHNOLOGIES

### 2.1. FUSED DEPOSITION MODELLING (FDM)

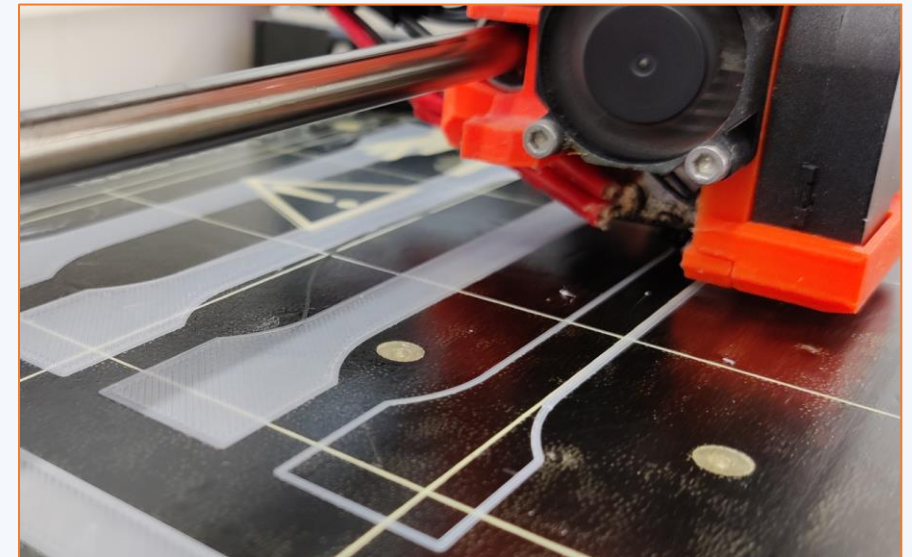
#### PROCESS:



*FDM machine. Detail of the extrusion head and printing.  
Source: CETEM*



*FDM machine. Detail of material feeding. Source:  
CETEM*



*FDM machine. Detail of the very first layers of a job. Source:  
CETEM*

## 2. ADDITIVE MANUFACTURING MAIN TECHNOLOGIES

### 2.1. FUSED DEPOSITION MODELLING (FDM)

**STRENGTHS AND WEAKNESSES:**

| FDM STRENGTHS                                                                                                                                            | FDM WEAKNESSES                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| Low cost. Both for the machine and for the materials.                                                                                                    | Low part quality or detail. Because the material is extruded in layers.                                                 |
| Scalability. Machines can be easily scaled to any size. FDM printers are available in larger constructions volumes.                                      | A lot of post-processing is needed to acquire a professional, finished look.                                            |
| Material flexibility. On the very same FDM printer, a wide variety of thermoplastic materials can be printed with relatively facility.                   | Weak points in the print where each layer is joined, making prints less sturdy and unsuitable for certain applications. |
| Cheap and accessible technology. It is perfect for beginners to 3D printing. Ease of access. Simply to use. FDM printers are relatively easy to operate. | Needs support structures in pieces with overhangs of more than 45 degrees.                                              |
| FDM printed objects can be used for a variety of purposes, and enhanced filaments still make them durable.                                               |                                                                                                                         |
| FDM printing is the most widespread technology so there are also many learning resources, troubleshooting guides, and so on, available.                  |                                                                                                                         |

## 2. ADDITIVE MANUFACTURING MAIN TECHNOLOGIES

### 2.1. FUSED DEPOSITION MODELLING (FDM)

#### APPLICATION AREAS:

As for applications areas for FDM technology, it is often used in the area of non-functional prototypes in order to produce concept parts, functional models, prototypes in general, manufacturing tooling and modeling, and end use parts. More specifically, FDM can be used for low-volume production and prototypes aimed at form, fit and function tests.

At the same time, it is most used in the aerospace sector, for example, to produce wind turbines. Anatomical models for medical use are also very much suitable to be built with this technology. Finally, FDM has slowly been enabling the rapid prototyping of biomedical micro devices, the kind of devices that are used daily in hospitals, for example, therefore very much fundamental, as it is considered both cheap, but at the same very safe.

In general, Fused Deposition Modelling is great for rapid prototyping as it can produce cheap copies of designs. There are also companies using FDM to create low-cost 3D final parts. Beyond industrial applications, FDM is the choice for most makers who like to tinker with models and print them at home.

Also, the education field can take advantage of this technology. As it is cheap, easy to use, affordable, etc., it can be introduced in the classroom very easily, for a better understanding of some subjects.

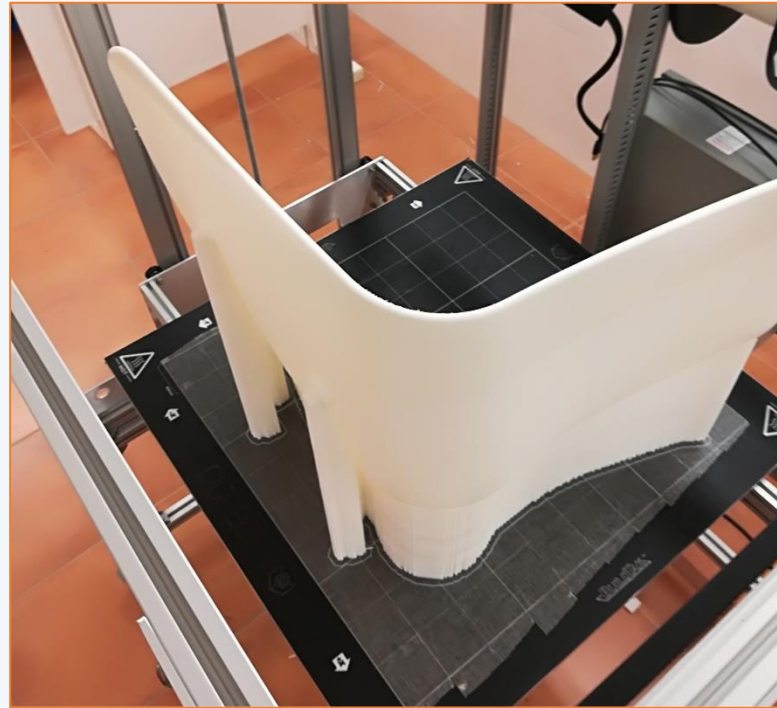


*FDM printed prototypes.  
Source: CETEM*

## 2. ADDITIVE MANUFACTURING MAIN TECHNOLOGIES

### 2.1. FUSED DEPOSITION MODELLING (FDM)

#### APPLICATION AREAS:



*FDM printed prototypes. Printing big pieces. Source: CETEM*



## 2. ADDITIVE MANUFACTURING MAIN TECHNOLOGIES

### 2.2. STEREOLITHOGRAPHY (SLA)

#### PROCESS:



*SLA machine with some pieces.  
Source: CETEM*

Stereolithography (SLA) is a light-based process that builds individual layers of a model using a liquid polymer, which is hardened by a high-power laser beam. It is the oldest technology in the history of 3D printing, and it is also one of the most widely used nowadays.

When the process starts, the laser “draws” the first layer of the print into the photosensitive resin. Wherever the laser hits, the liquid solidifies. The laser is directed to the appropriate coordinates by a computer-controlled mirror.

After the first layer, the platform is lowered (or raised, depending on the machine configuration) according to the layer thickness and the additional resin flows to the already-printed portion. The laser then solidifies the next cross-section, and the process is repeated until the whole part is complete. The resin that is not touched by the laser remains in the vat and can be reused.



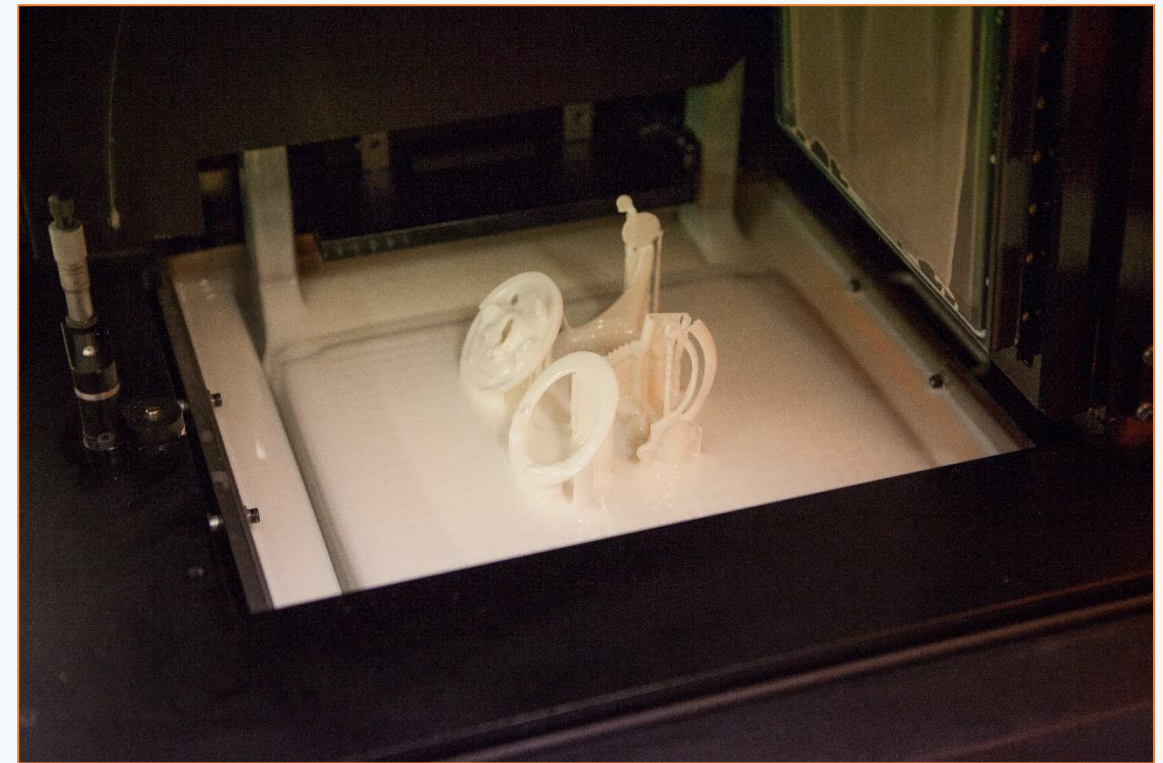
## 2. ADDITIVE MANUFACTURING MAIN TECHNOLOGIES

### 2.2. STEREOLITHOGRAPHY (SLA)

#### PROCESS:



*SLA machine. Detail of the bed or platform and the resin vat . Source: CETEM*



*SLA machine. Detail of the finished pieces emerging from the vat. Source: CETEM*

## 2. ADDITIVE MANUFACTURING MAIN TECHNOLOGIES

### 2.2. STEREOLITHOGRAPHY (SLA)

#### STRENGTHS AND WEAKNESSES:

| SLA STRENGTHS                                                                    | SLA WEAKNESSES                                                                                                                          |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Fast implementation of prototypes in early stages of product development.        | Depending on the material, components may be brittle, fragile, and therefore, not suitable functional prototypes or mechanical testing. |
| Single-stage production process produces smooth surfaces even without finishing. | Machines can be very expensive.                                                                                                         |
| Low material consumption: non-hardened synthetic resin can be reused.            | The liquid resin is much more expensive than the filaments used in FDM printing, for example.                                           |
| It is possible to print complex geometries and patterns, and fine features.      | SLA offers limited material and color choice, usually offering black, white, grey and clear material.                                   |
| Build volumes can be as high as 50cm, without sacrificing precision.             | Required support structures in pieces with overhangs.                                                                                   |
| SLA resin 3D printers create highly isotropic and watertightness parts.          |                                                                                                                                         |

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## 2. ADDITIVE MANUFACTURING MAIN TECHNOLOGIES

### 2.2. STEREOLITHOGRAPHY (SLA)

#### APPLICATION AREAS:

Stereolithography is good for producing accurate prototypes and models. It is well used for creating accurate 3D models of anatomical parts of a patient, to aid in diagnosis and for pre-planning and implant design and manufacture. It is also good in concept models and scale models.

Stereolithography is used for prototyping to assess design and for part validation. This is due to accuracy and its ability to produce irregular shapes.

SLA 3D printing accelerates innovation and supports businesses across a wide range of industries, including engineering, manufacturing, dentistry, healthcare, education, entertainment, jewelry, audiology, and more. To sum up, SLA top applications are the following:

- Fit/form, proof of concept prototypes and engineering verifications
- Investment Casting Patterns
- Rapid Tooling, Jigs & Fixtures
- Designer models, snap-fit assemblies
- Scale & exhibition models
- Optics, transparent covers
- Molds & casting patterns



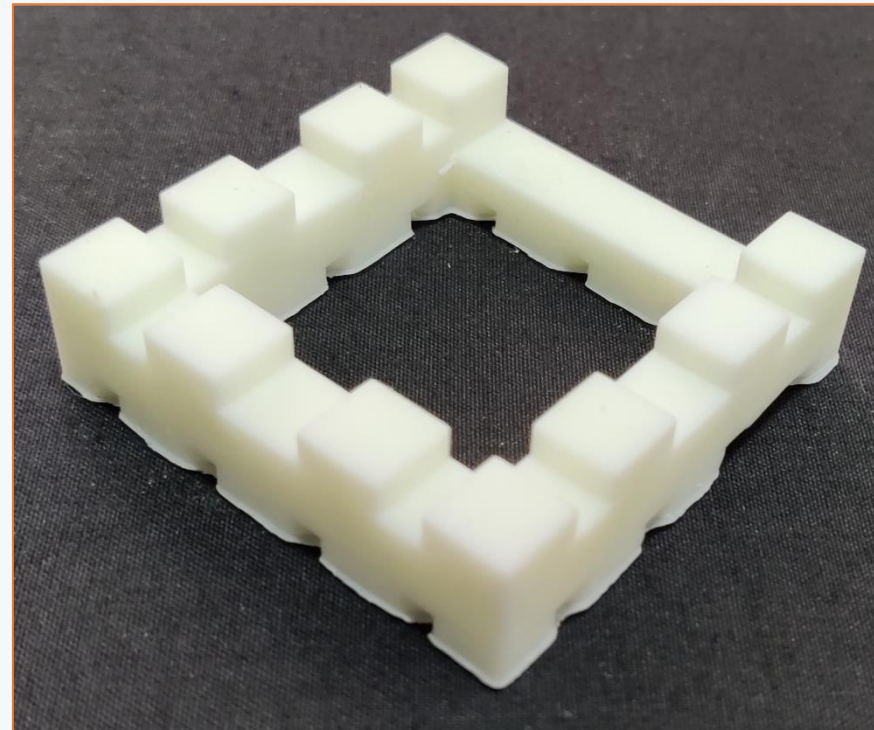
*SLA printed prototypes. Proof of concept prototype  
Source: CETEM*



## 2. ADDITIVE MANUFACTURING MAIN TECHNOLOGIES

### 2.2. STEREOLITHOGRAPHY (SLA)

#### APPLICATION AREAS:



SLA printed prototypes. Source: CETEM

## 2. ADDITIVE MANUFACTURING MAIN TECHNOLOGIES

### 2.3. SELECTIVE LASER SINTERING (SLS)

#### PROCESS:

Selective Laser Sintering (SLS) is a technique that uses a laser as power source to form a solid 3D object layer by layer by sintering little powder particles. The mere process involves a laser which is used to selectively sinter a layer of granules, binding together the material to create a solid form. At the end of the process, the object may be very hot and therefore it will be left to cool off before being removed from the machine.

The 3D printing material is stored in two different chambers, although some machines can have just one.

So, the levelling rolling disperses a thin layer on top of a platform inside the build chamber. The printer preheats the powder to a temperature slightly below the raw material melting point, making it easier for the laser to increase the temperature of specific areas of the powder bed, as it moves through the model, solidifying the part.

The laser travels through a cross section of the 3D model and heats the powder to a temperature lower than or equal to the melting point of the material. This process melts the particles together and mechanically joins them to create a solid piece. The unfused powder is used as a support for the overhangs, inner spaces, holes, etc., of the part during the printing, and eliminates the need of support structures. Also, it can be reused. The platform then lowers a distance equal to the layer height, and the process is repeated on each layer, until the part or parts are complete.

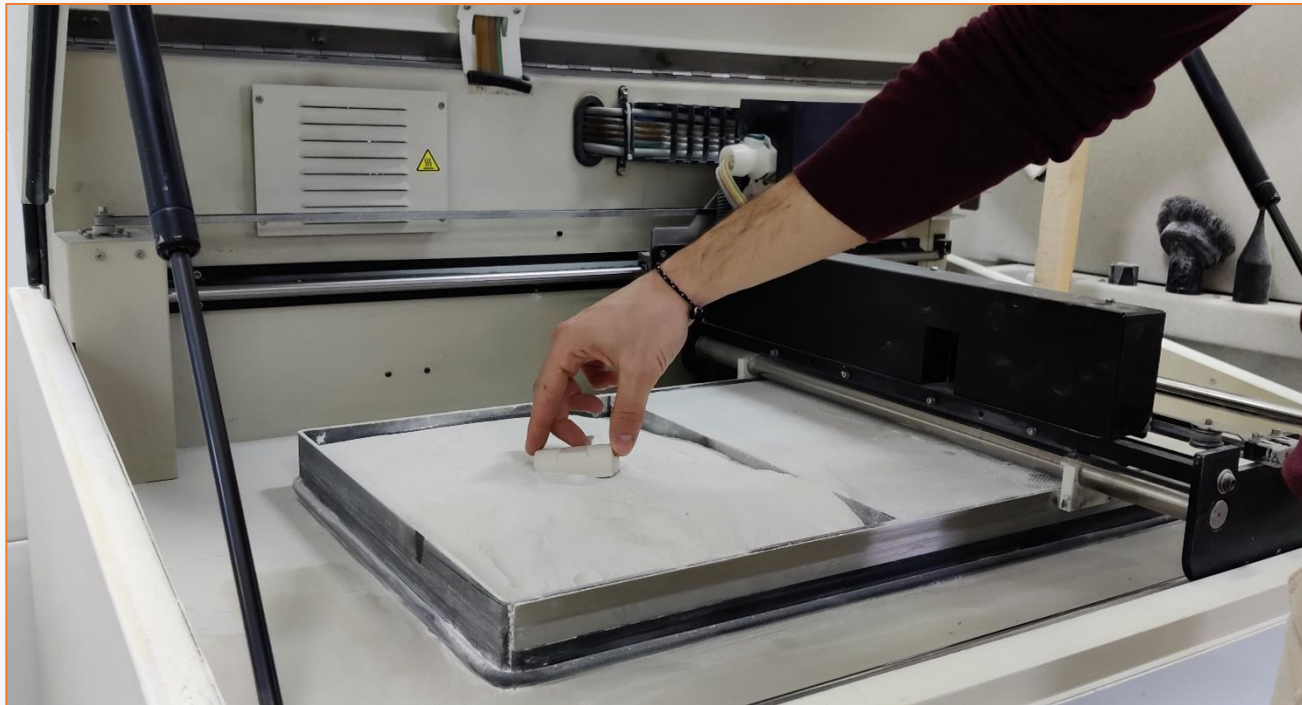
After the printing process itself, the printing chamber must be cooled slowly slightly inside the printing chamber and then outside the printer, to ensure optimal mechanical properties and prevent parts from warping and other issues.



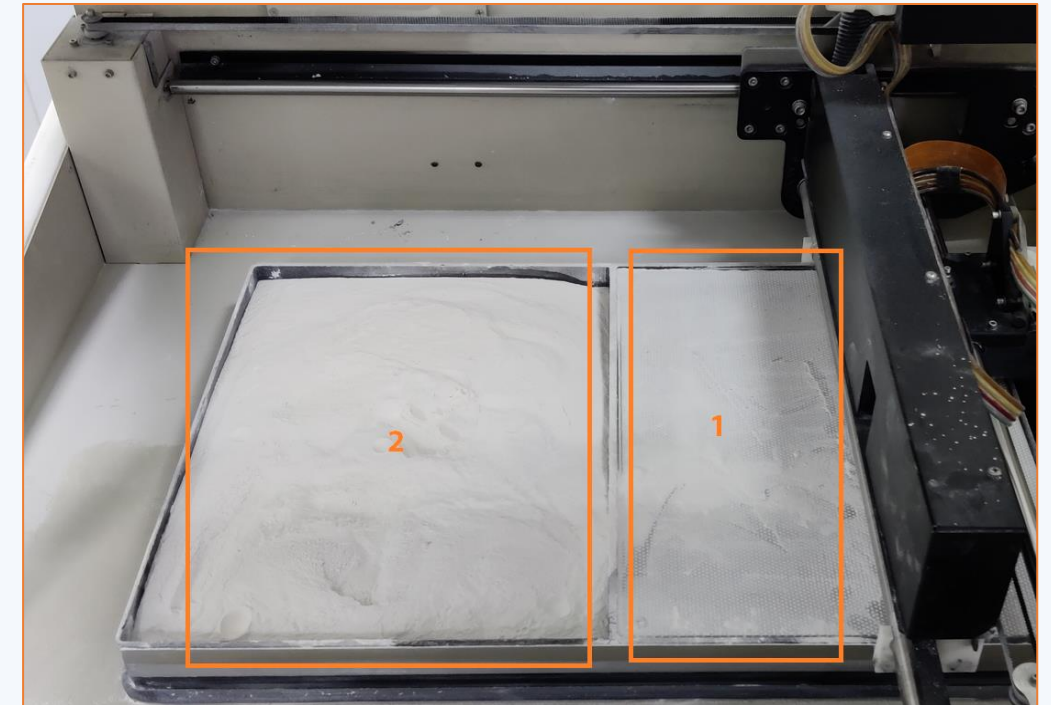
## 2. ADDITIVE MANUFACTURING MAIN TECHNOLOGIES

### 2.3. SELECTIVE LASER SINTERING (SLS)

#### PROCESS:



SLS machine. Source: CETEM



SLS machine. Detail of the chambers for powder. 1: Building platform.  
2: Powder chamber. Source: CETEM

## 2. ADDITIVE MANUFACTURING MAIN TECHNOLOGIES

### 2.3. SELECTIVE LASER SINTERING (SLS)

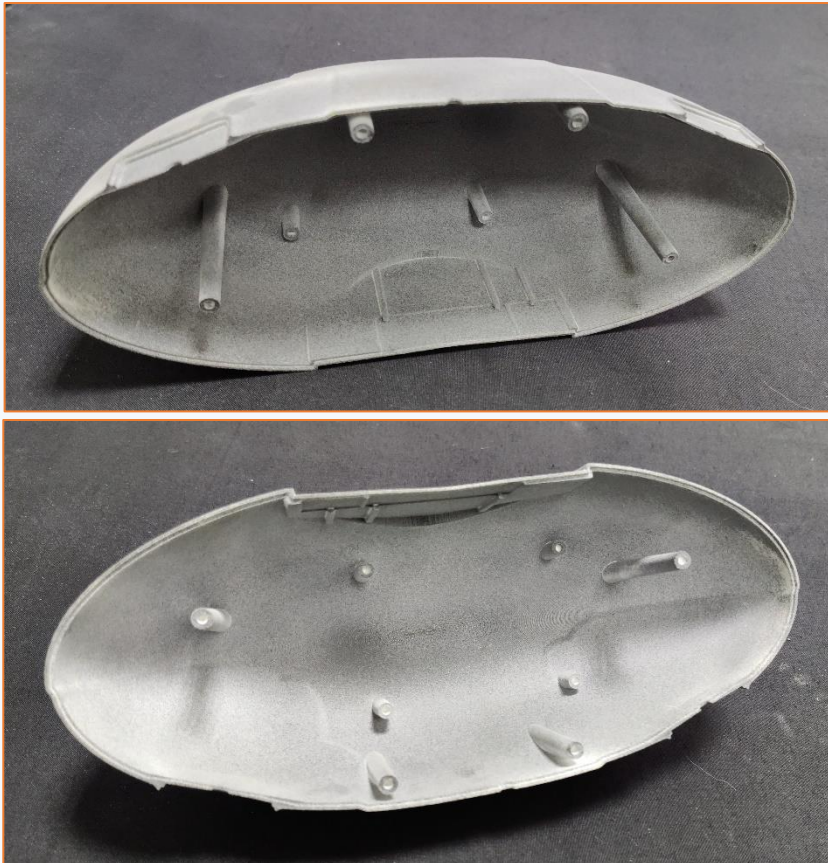
**STRENGTHS AND WEAKNESSES:**

| SLS STRENGTHS                                                                                                                         | SLS WEAKNESSES                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| SLS parts have good, isotropic mechanical properties.                                                                                 | SLS machines are very expensive, compared to other technologies.                                                                 |
| SLS requires no support, so designs with complex geometries can be produced easily, or movable parts with complicated inner geometry. | SLS parts have a grainy surface finish and internal porosity.                                                                    |
| SLS is excellent for small to medium batch production.                                                                                | Large flat surfaces and small holes cannot be printed accurately with SLS, as they are susceptible to warping and oversintering. |
| SLS printing has the potential to be one of the fastest 3D printing technologies.                                                     | Cleaning of the machine must be done precisely when changing material to avoid contamination.                                    |
| SLS printing has been known to result in prints with very strong layer adhesion.                                                      |                                                                                                                                  |
| Durable printouts, and powder is reusable after printing.                                                                             |                                                                                                                                  |

## 2. ADDITIVE MANUFACTURING MAIN TECHNOLOGIES

### 2.3. SELECTIVE LASER SINTERING (SLS)

#### APPLICATION AREAS:



*SLS printed prototypes. Proof of concept prototype.  
Source: CETEM*

SLS 3D printing accelerates innovation and drives business in many industries, including engineering, manufacturing, and healthcare.

In engineering, it allows the fast creation of prototypes and the simulation of products for having the customer opinion. It is also suitable for producing functional prototypes.

In manufacturing, SLS can be used for end-use production, or small batch production, or even mass production of new personalized consumer products. Replacement parts can be also done, as well as durable fixtures and fittings, and tooling.

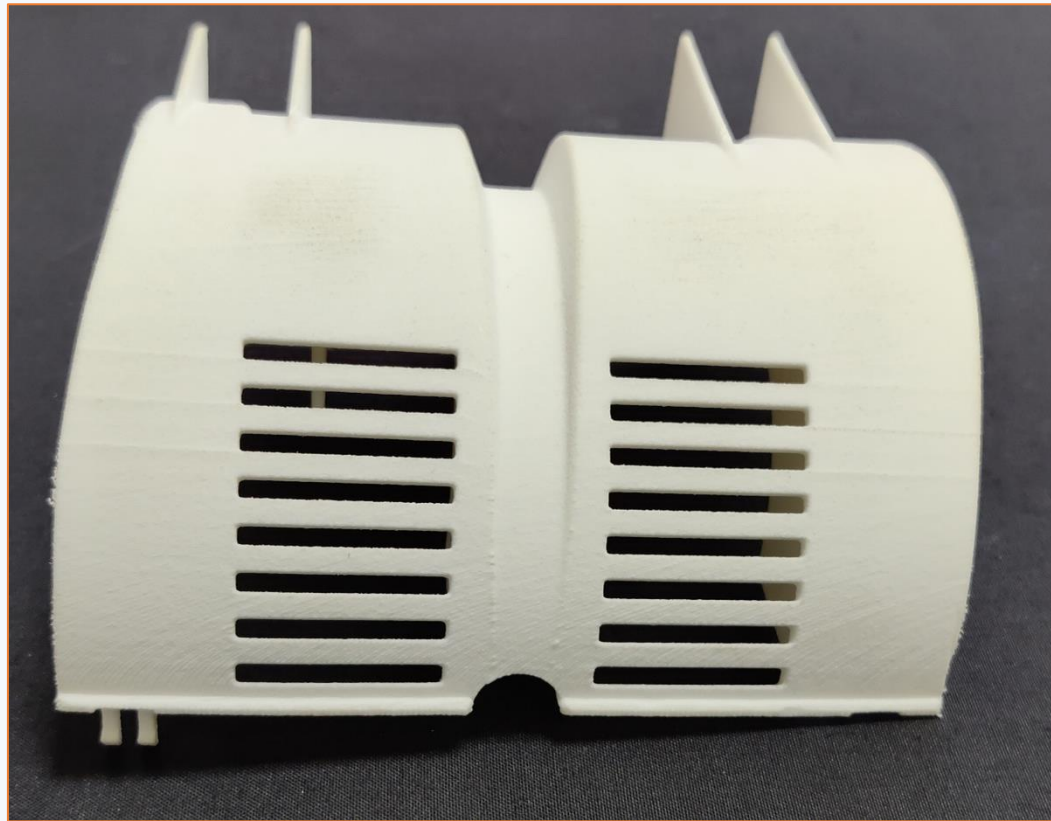
For medical purposes, SLS has been proved to be good for manufacturing custom medical devices for patients on site, ready for use, like medical devices prototypes, prosthetics and orthotics, surgical models and tools, and also end-use parts.



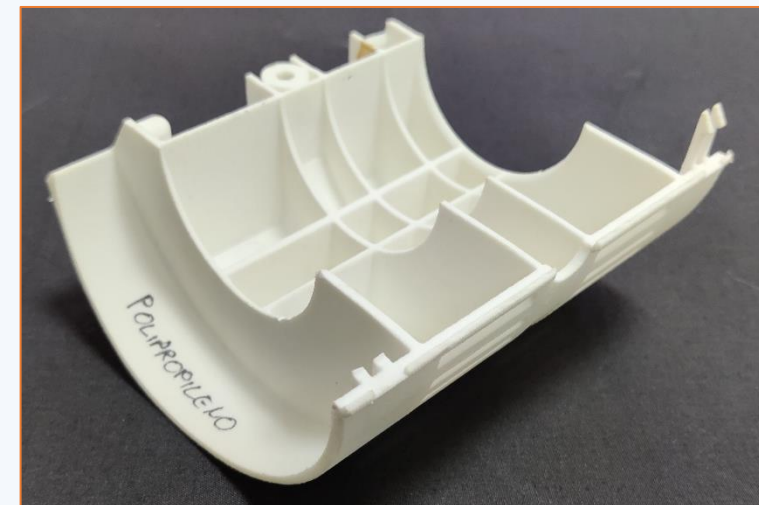
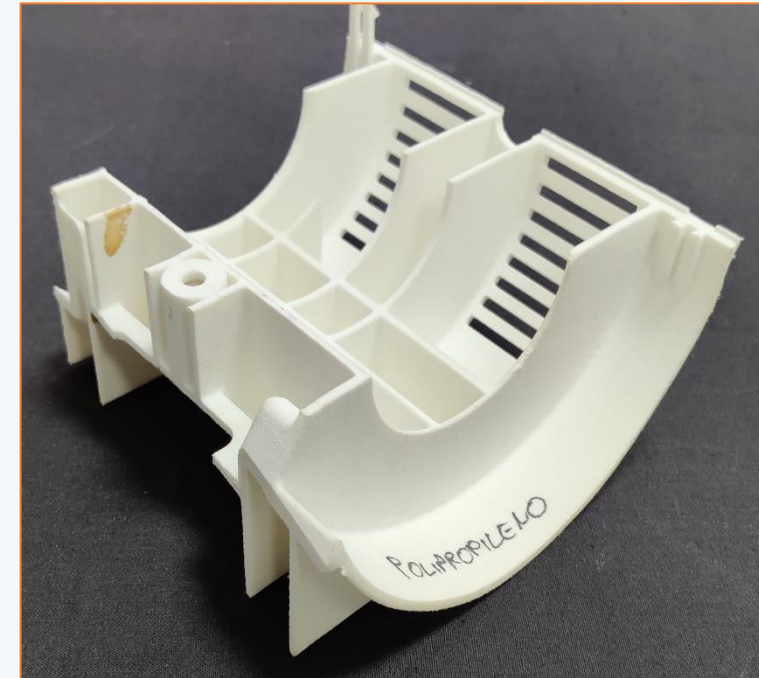
## 2. ADDITIVE MANUFACTURING MAIN TECHNOLOGIES

### 2.3. SELECTIVE LASER SINTERING (SLS)

#### APPLICATION AREAS:



*SLS printed prototype. Source: CETEM*



### 3. PRODUCTION PROCESS FOR 3D PRINTING WITH FDM

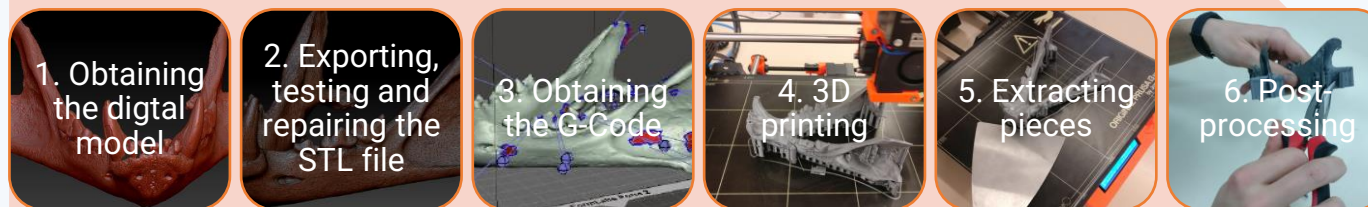
Always starting with a digital design of a model, piece, part, etc., some processes and steps for obtaining a real 3D printed piece must be followed.

Examples of them are:

- Obtaining the digital model;
- Exporting, testing and repairing the STL file;
- Selection of parameters and getting the G-Code;
- 3D printing process;
- Extracting pieces and post-processing.

They should be adapted according to the type of piece, selected technology, type and size of machine, and even the software.

In the production process for 3D printing with FDM, a lot of things have great impact, like the experience in the field of the operator, the features of the piece, part, model, etc., to be printed, available 3D printer or machine, available materials, among others.





### 3. PRODUCTION PROCESS FOR 3D PRINTING WITH FDM

#### 3.1. OBTAINING THE DIGITAL MODEL

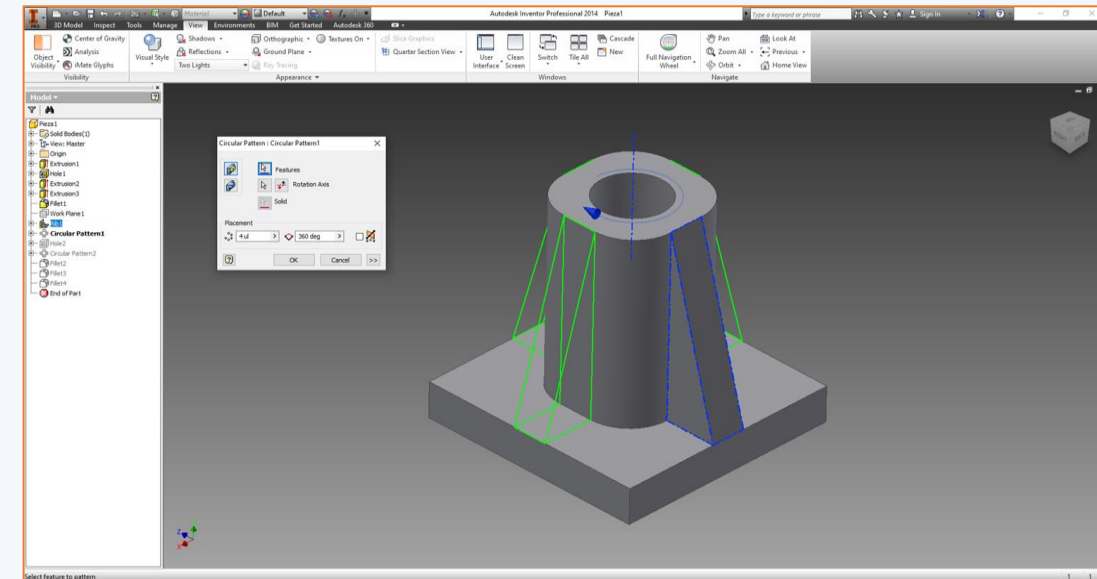
For obtaining the 3D model or digital model to print, there are different possibilities:

- **Using CAD software**
- **Reverse Engineering**
- **Repositories**

For the first option, a computer aided design software (CAD software) must be used.

Reverse Engineering process is useful when the pre-existing geometry of a real object wants to be captured. The digitization of existing products, either to incorporate them directly into new production system or just to generate new products based on them, is a very powerful tool for a lot of professional users and companies.

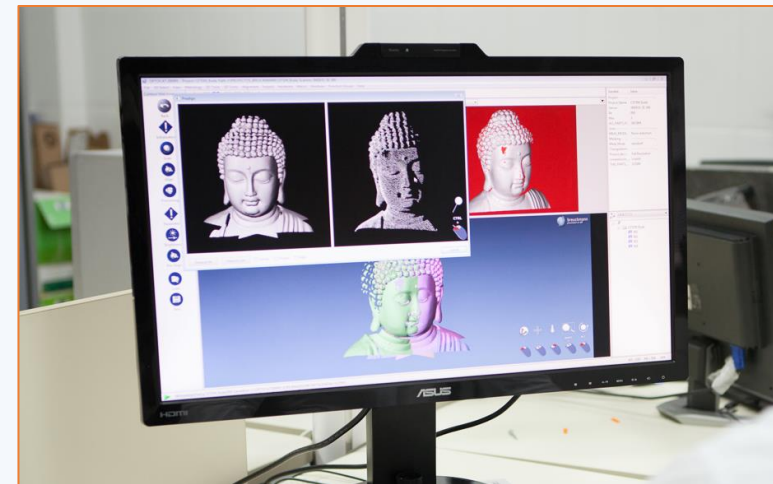
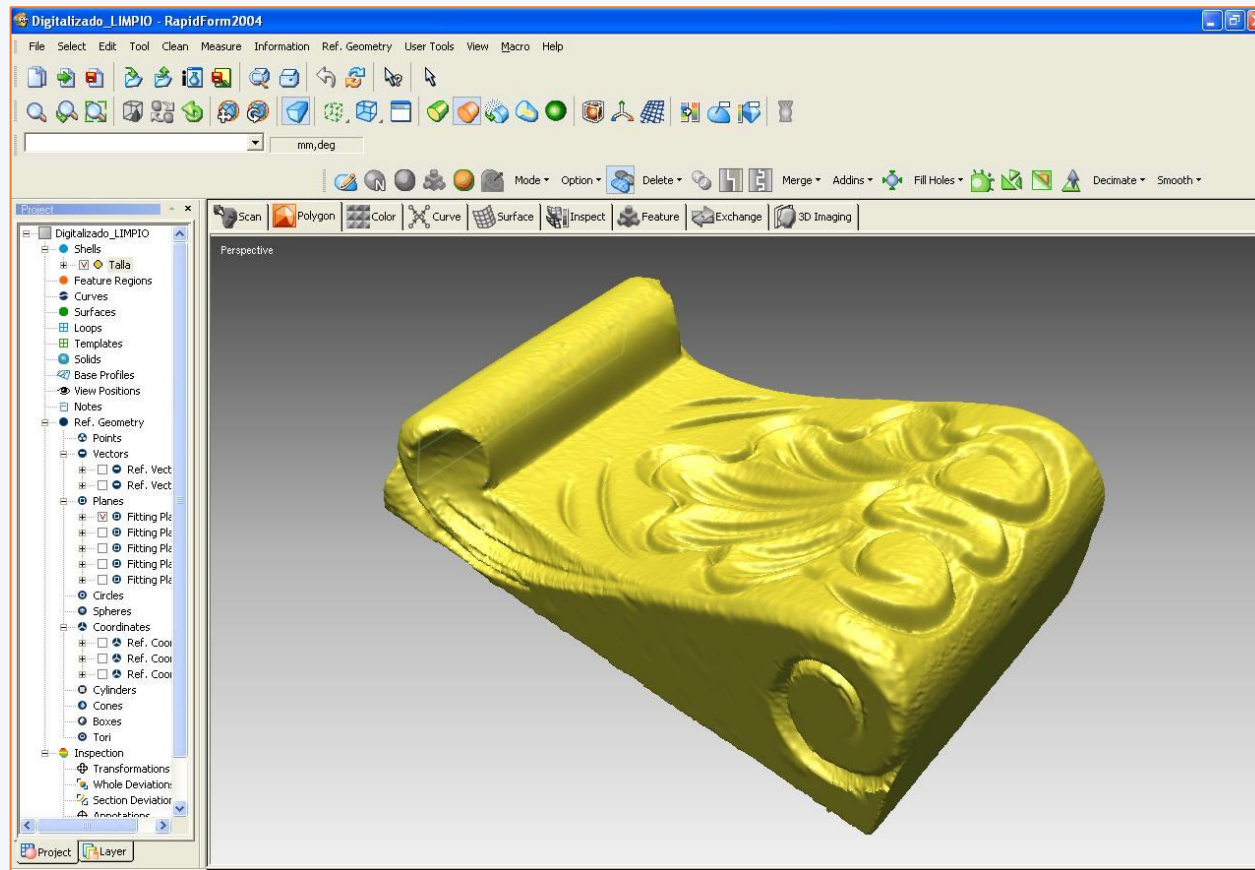
Finally, when there is no knowledge for computer-aided design, or there is no equipment and knowledge for applying a process of reverse engineering, the best choice is to download the model from a repository or library.



*Designing in CAD software. Source: CETEM*

# 3. PRODUCTION PROCESS FOR 3D PRINTING WITH FDM

## 3.1. OBTAINING THE DIGITAL MODEL



On the left: geometry acquired by reverse engineering. On the right: using a 3D scanner for obtaining certain geometry. Source: CETEM

## 3. PRODUCTION PROCESS FOR 3D PRINTING WITH FDM

### 3.2. EXPORTING, TESTING AND REPAIRING THE STL FILE

When working with 3D printing, STL format file is the most used one. In simple terms, this format uses linked triangles, in order to recreate the solid model surface.

Sometimes, when exporting to STL, some problems may arise, either because the model is not good enough for 3D printing or the design in the CAD software has not been made correctly, or either because there are other reasons, such as the design coming from 3D scanning. So, it is suitable to analyse the model, piece or part to print, to detect any kind of error, and if so, repair it and have a nice and correct model to prepare to print in the follow steps. There are different types of software for analyzing and repairing the digital model. Aspects to be analyzed and corrected may be:

- Thickness.
- Holes and gaps.
- Duplicated faces or triangles, or vertices.
- Reversed triangles.
- Singular points or faces (noise).



*Some noise to eliminate in a 3D scanned model.  
Source: CETEM*

## 3. PRODUCTION PROCESS FOR 3D PRINTING WITH FDM

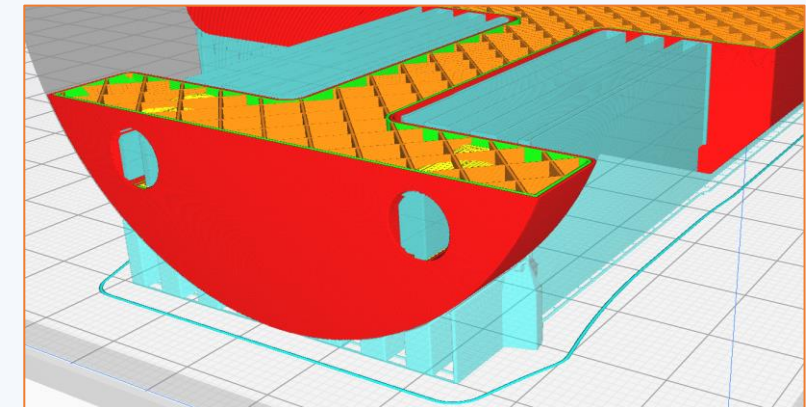
### 3.3. OBTAINING THE G-CODE

Once you have a digital model ready and prepared for 3D printing, it is time to generate what is known as G-Code or machine code. This code is the translation of the piece, and all its associated parameters regarding the process of printing, into instructions for the machine.

So, this stage of the production process in 3D printing is about preparing the model in terms of physical distribution, orientation, location, etc.

And for this, it is necessary to choose some printing parameters:

- **Support structures:** for parts of the piece with overhangs, internal gaps, holes, etc.
- **Infill of the model:** Internal structure of the printed object. Density and shape must be chosen.
- **Orientation:** Position and orientation of the model inside and on the printing bed. There is different criteria: using minimum amount of material, reduce time, achieving quality surface, etc.
- **Other relevant parameters:** for example, layer height (or layer thickness), wall thickness, temperatures for bed surface and nozzle (extruder), initial layer height, print speed, etc.

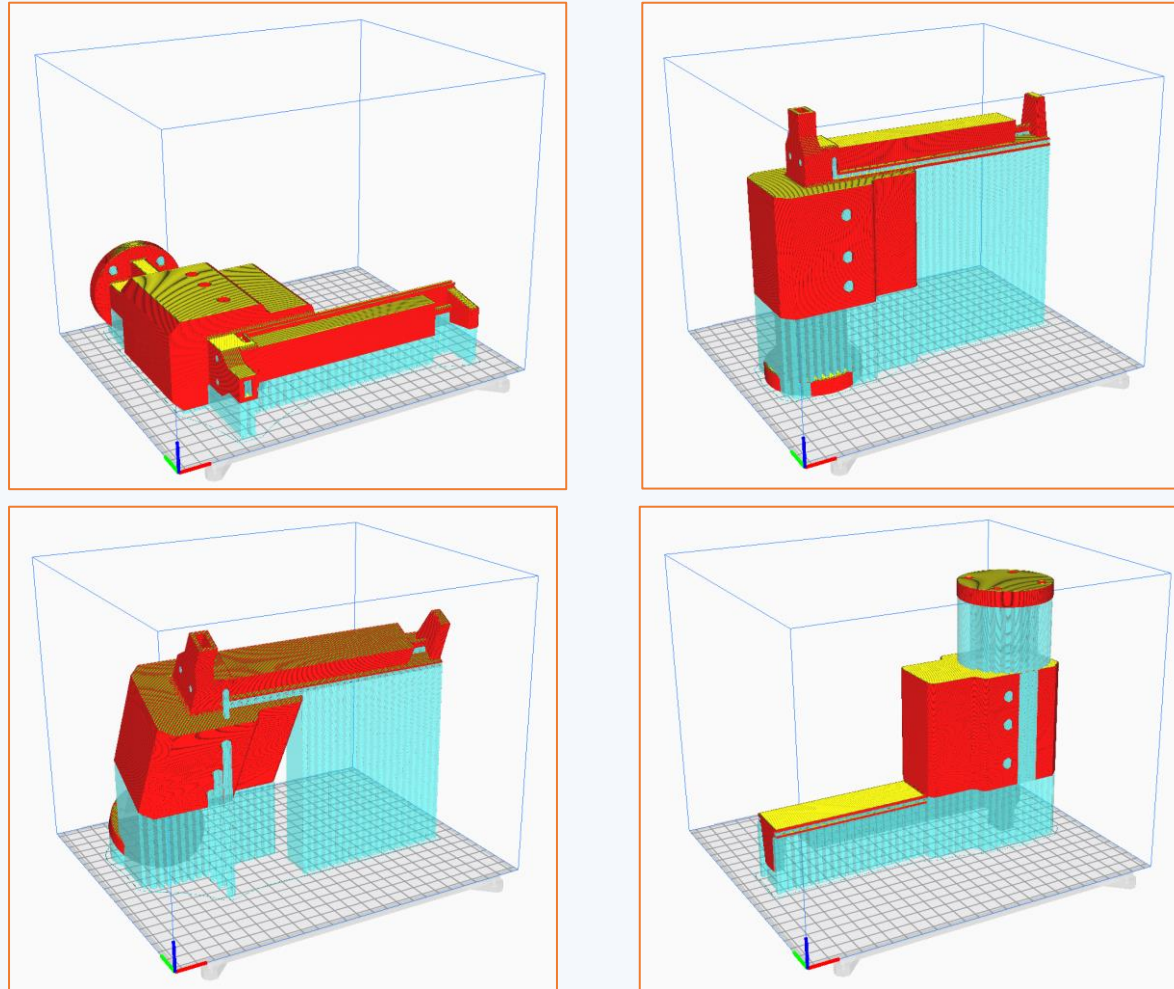


*Obtaining the G-Code. Simulation. Blue: support structures. Orange: infill. Red: walls. Source: CETEM*

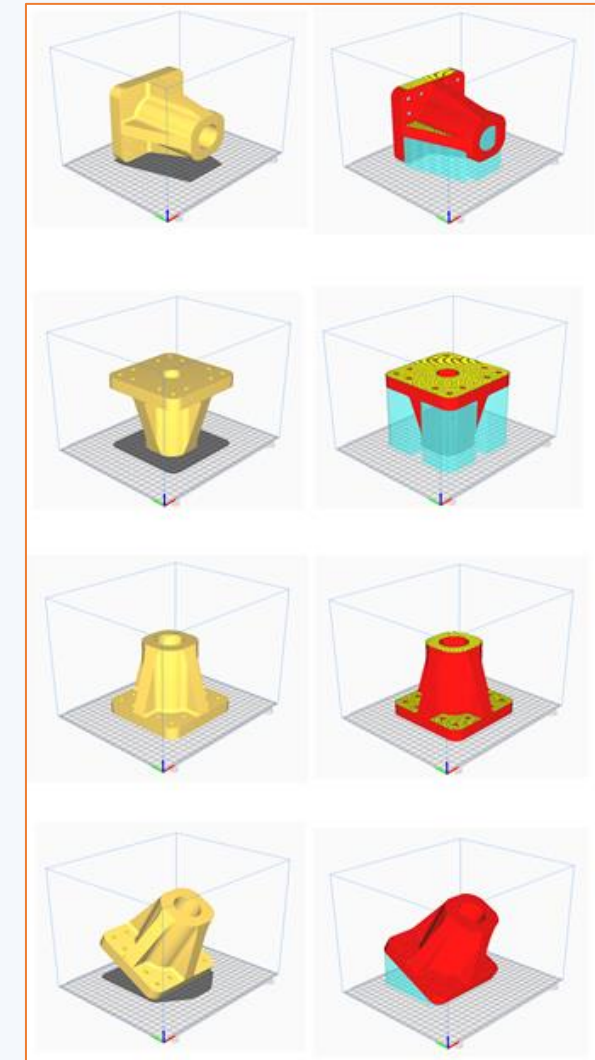


# 3. PRODUCTION PROCESS FOR 3D PRINTING WITH FDM

## 3.3. OBTAINING THE G-CODE



*Different orientation for a same piece. Source: CETEM*



*Different orientation for a same piece.  
Source: CETEM*



## 3. PRODUCTION PROCESS FOR 3D PRINTING WITH FDM

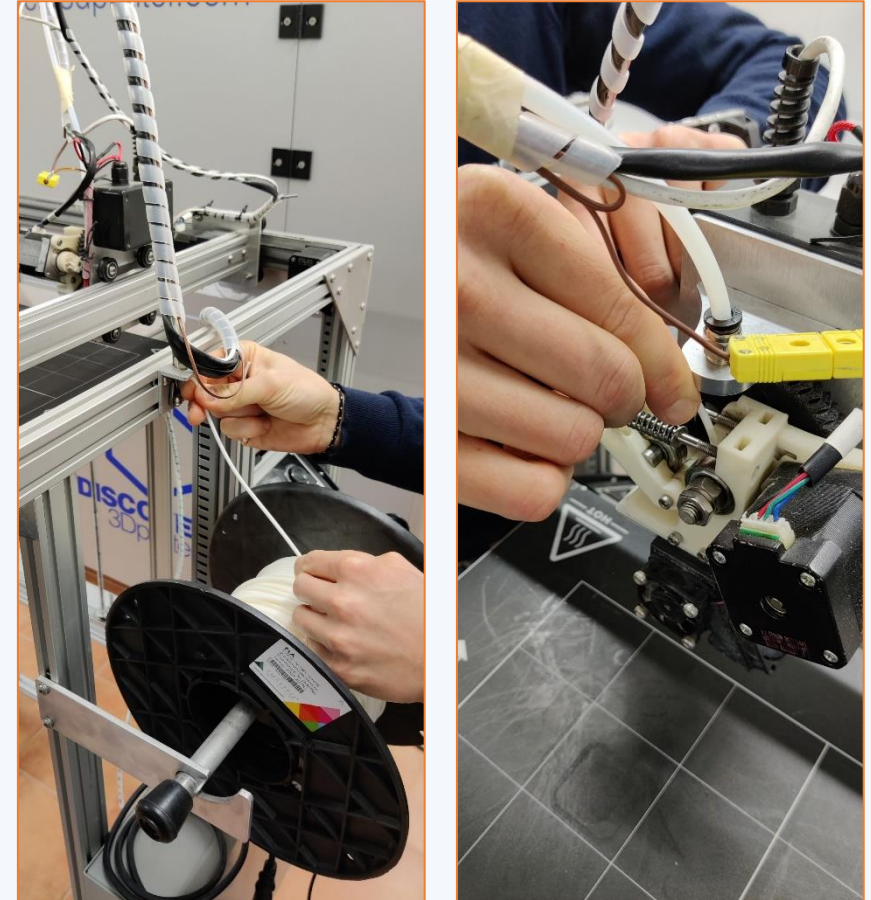
### 3.4. 3D PRINTING

The generated G-Code is just a file the 3D printer needs to read. For that, you may use a SD card, a pen drive device or there are even 3D printers that have an online interface, where you can control the process and launch the jobs, from your PC.

For FDM printers, it is recommended to pre-heat both bed and extruder, so the machine is heated before the job starts.

It is also advisable to use some kind of lacquer or varnish in order to improve the bed adhesion. For this purpose, there are a lot of products available in the market for it. It is possible also to use double side tape.

FDM machines also needs to be fed of material, which come in the form of filament. The way to do it will depends on the type of the machine.



*Feeding a FDM 3D printer. Source: CETEM*

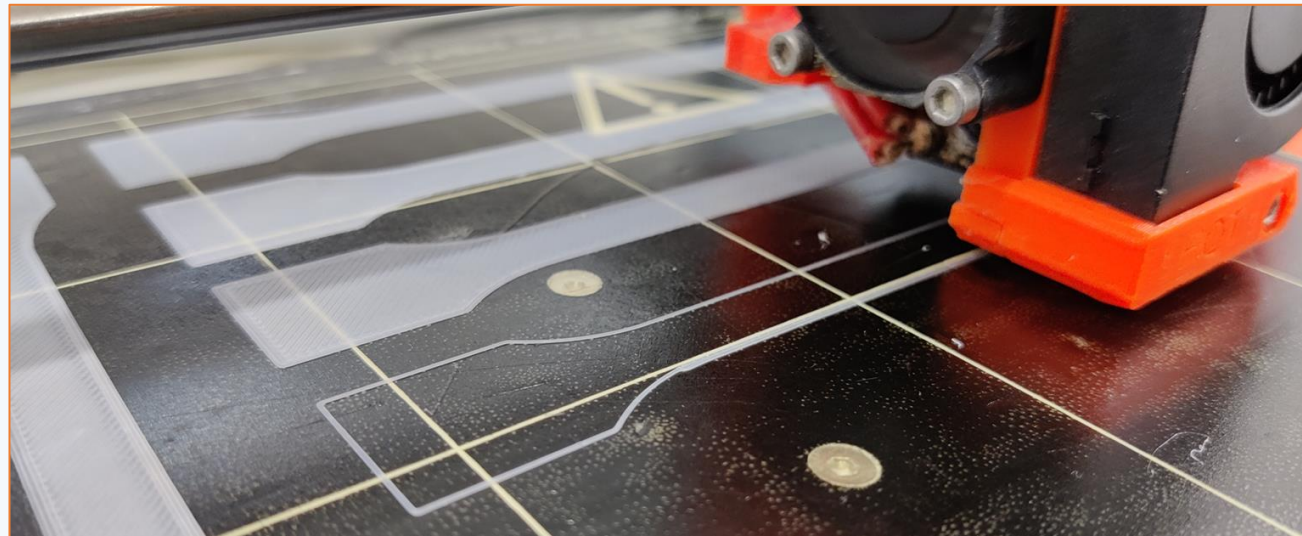
### 3. PRODUCTION PROCESS FOR 3D PRINTING WITH FDM

#### 3.4. 3D PRINTING

With the printed fed of filament, preheated to the working temperatures, and with the G-Code loaded, it is time to launch the job and let the machine to do its work.

Once the job is launched, it is advisable to watch the first layers, to check for any adhesion problems.

It is important to notice that during the printing process (in FDM) a lot of issues may occur, but there are available a lot of troubleshooting online guides for solving very different kind of problems.



*First layer of a FDM job. Source: CETEM*

### 3. PRODUCTION PROCESS FOR 3D PRINTING WITH FDM

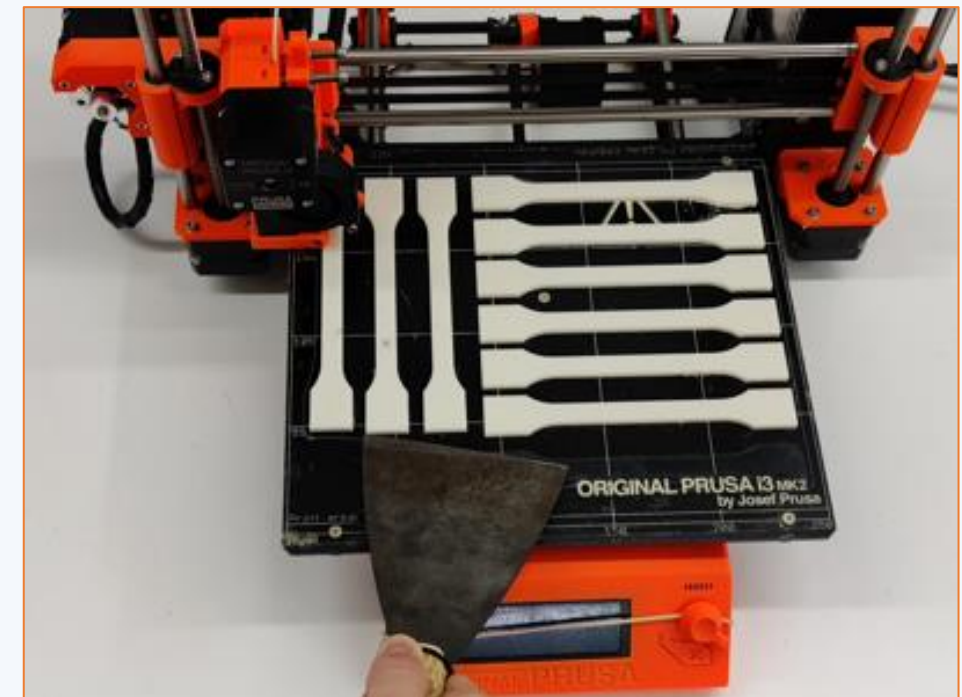
#### 3.5. EXTRACTING PIECES

If the 3D printing process has finished without any problem, it is time to implement the process of extracting the piece/s.

FDM pieces usually remain stucked to the bed surface, and sometimes they can be very hard to remove, specially when using special glues, varnish or lacquers for improving layer adhesion.

So, there are different methods for extracting FDM pieces:

- Applying brute force.
- Use a flat blade.
- Using a flexible build plate.
- Adding another surface or buffer layer to the build plate.
- Cooling the bed surface down.
- Floss it off.
- Using a solvent.



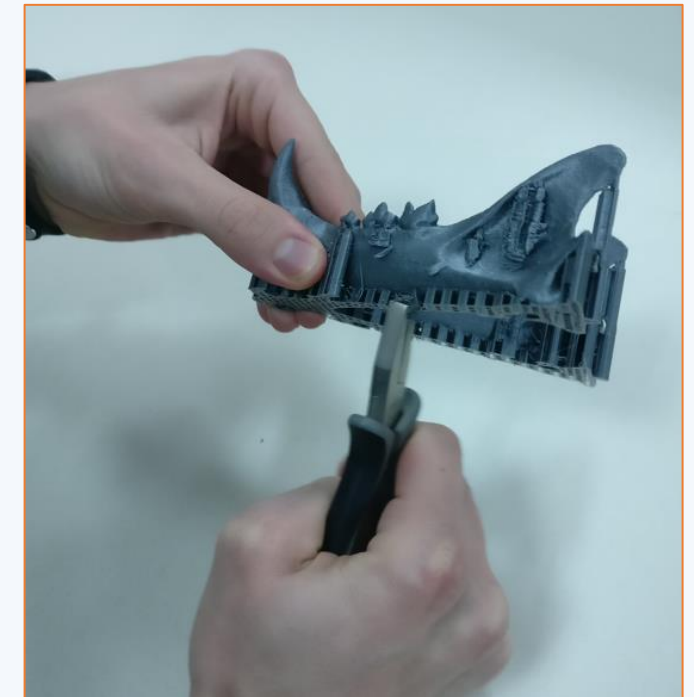
*Using a spatula for removing pieces from the bed surface.  
Source: CETEM*

## 3. PRODUCTION PROCESS FOR 3D PRINTING WITH FDM

### 3.6. POST-PROCESSING

Once the pieces have been removed from the 3D printer, it is time to see if some post-processing is needed. For FDM, post-processing may consist in:

- Removing support structures.
- Sanding.
- Polishing.
- Applying coatings.
- Shot blasting.
- Smoothing with acetone vapor.
- Etc.



*Using pliers for removing support structures. Source: CETEM*



### 3. PRODUCTION PROCESS FOR 3D PRINTING WITH FDM

#### 3.6. POST-PROCESSING



*On the left: applying filler. On the right-up: sanding for preparing for painting. On the right-down: applying paint. Source: CETEM*



## 4. CONCLUSIONS



The term 3D printing encompasses several manufacturing technologies that build parts layer-by-layer. Each varies in the way they form plastic and metal parts and can differ in material selection, surface finish, durability, and manufacturing speed and cost.

Selecting the right 3D printing process for your application requires understanding each process's strengths and weaknesses and mapping those attributes to your product development needs.

It's safe to say 3D printing is most often used for prototyping. Its ability to quickly manufacture a single part enables product developers to validate and share ideas in a cost-effective manner. Determining the purpose of the prototype, piece or model will inform which 3D printing technology will be the most beneficial. Additive manufacturing can be suitable for a range of prototypes that span from simple physical models to parts used for functional testing.

Regarding the process of obtaining a digital model, it is important to notice that the most difficult alternative of all is to use reverse engineering, because it involves several sub-technologies and techniques, as well as software. The best option for the vast majority of users is to design their own pieces, with a 3D CAD software, but some design knowledge is required for that.

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# Fostering diGitalisation and blonic transformation of SMEs through the development of a novel and innovative Training material for overcoming COVID-19 crisis

[HTTPS://GIST-PROJECT.EU/](https://gist-project.eu/)



**Thank  
you**

# TU.1

# LU.4

**TRAINING UNIT 1 – I4.0 TECHNOLOGIES**

**LEARNING UNIT 4- ROBOTICS**



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## 1. Introduction

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### 1.2. ADVANTAGES AND DISADVANTAGES

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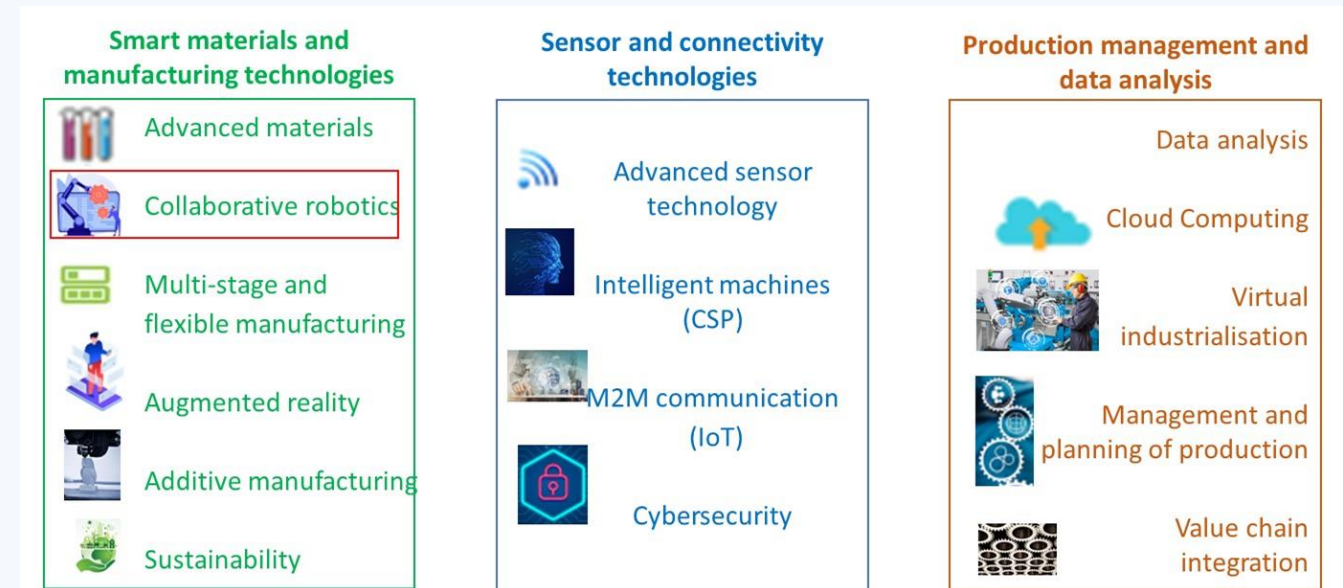


# 1. INTRODUCTION

## 1.1. AUTOMATION AND INDUSTRIAL AND COLLABORATIVE ROBOTS

In the context of INDUSTRY 4.0, robotics can be defined as a specific case of automation, a field of great importance now and in the future. In robotics, advanced and collaborative robots are those robots equipped with sensor elements that work alongside human operators in agile manufacturing environments, where worker's security is a key factor.

In the context of I4.0 enabling technologies, advanced and collaborative robots are a highlight both at present and in the future, due to the significant implementation of robots by the leading companies in every sector, as well as the clear and enormous growth potential.



*I4.0 enabling technologies. Source: Own elaboration based on Automation and Robotics State of Art from Xunta de Galicia 2017*

# 1. INTRODUCTION

## 1.1. AUTOMATION AND INDUSTRIAL AND COLLABORATIVE ROBOTS

There are several formal definitions for the term 'industrial robot':

- **ISO (International Standards Organization)** has adopted RIA (Robotics Industrial Association) definition. In this case, ISO 8373 defines industrial robot as: "A re-programmable multifunctional manipulator designed to move material, parts, tools or specialized devices through variable programmed motions for the performance of a variety of tasks".
- **IFR (International Federation of Robotics)** defines it as: "A multifunctional programmable automatic handling machine with three or more axes which can position and orient materials, workpieces, tools or special devices for various tasks in the different stages of industrial production, either in a fixed position or in motion".



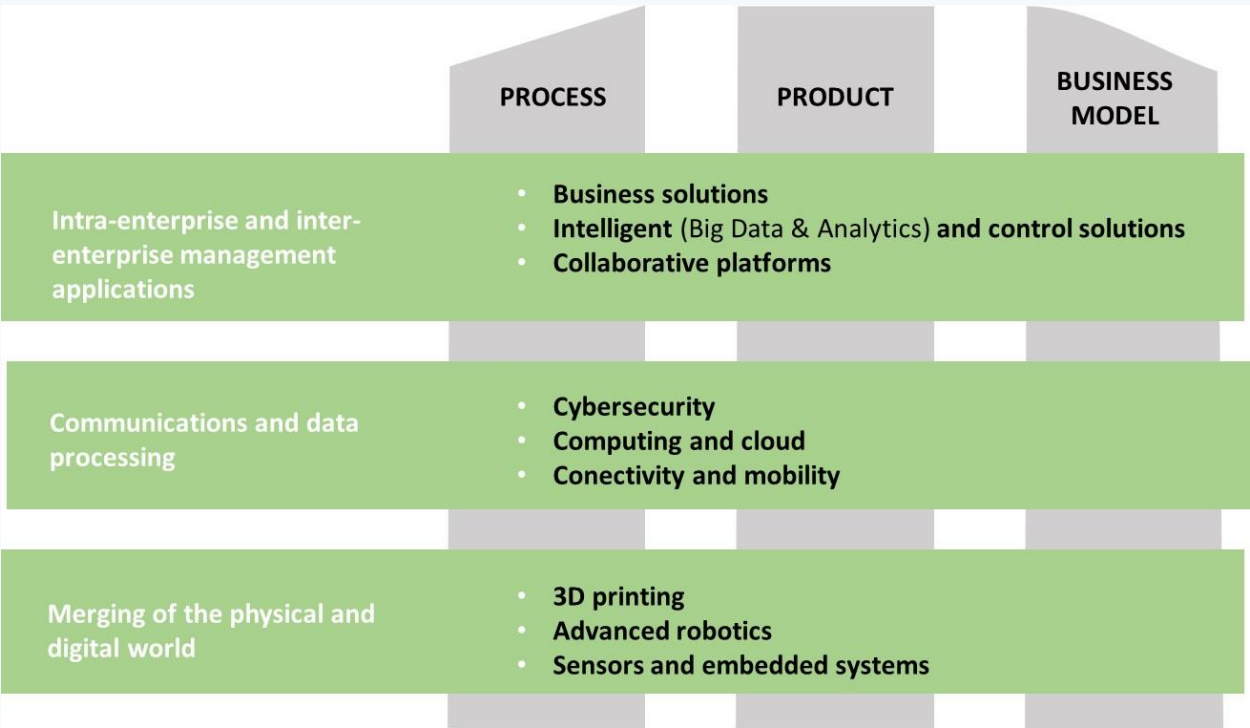
# 1. INTRODUCTION

## 1.1. AUTOMATION AND INDUSTRIAL AND COLLABORATIVE ROBOTS

Advanced and collaborative robotics constitute one of the most relevant digital enablers (technologies that enable digital transformation) in the industrial sector.

Robotic systems are able to process and carry a multitude of items. They are systems that can perform multiple tasks and also have the ability to perceive what is happening around them, interacting with their environment and communicating with other machines and/or people.

Considering their real-time data processing, the versatility of these systems allows its implementation in multiple industrial sectors.



Industry 4.0 digital enablers. Source: Ministry of Economy, Industry and Competitiveness

Advanced and collaborative robotics go beyond the aforementioned definitions. As a digital enabler, they allow the hybridisation between physical and digital worlds (linking both of them to reach a evolution towards true smart industries).

## 1.1. AUTOMATION AND INDUSTRIAL AND COLLABORATIVE ROBOTS

Because of its versatility, advanced and collaborative robotics can act as a leverage to multiple sectors to stimulate real digital transformation and to achieve Industry 4.0 objectives:

- Manufacturing **flexibility**: changes in product configuration that don't affect production times.
- **Customisation**: adaptation to customer's requirements.
- **Optimisation** of decision-making: thanks to the availability of the maximum amount of up-to-date information in real time.
- **Productivity** gains: to maximize resource efficiency.



Collaborative robotics in industrial sector. Source: CFZ Cobots <https://cfzcobots.com/>



## 1.2. ADVANTAGES AND DISADVANTAGES

### Advantages of collaborative robots:

- Human-machine cooperation under high safety conditions.
- **Flexibility** to perform a wide range of tasks: pick & place, assembly, packaging, welding, screwing, etc.
- **24-hour** productivity.
- **Quality**: real-time monitoring of quality parameters.
- **Easy programming**: possibility to teach the robot by guiding its arm through the movements to be performed.
- **Speed**: at repetitive processes.
- **Reduced batch size.**
- Improvement in **ergonomics**.
- High **reliability**.
- **Reconfiguration**: in machines and production facilities.
- **Integration**: processes and systems.
- **Efficiency**: maximum utilisation of resources.
- Wider range of **automatable tasks**.
- **Human-robot** partnership.



Advantages of robotics. Source: <https://www.istockphoto.com/>

## 1.2. ADVANTAGES AND DISADVANTAGES

**Limitations and barriers** in collaborative robotics:

- Relatively high initial expenses.
- Low payload capacity due to physical and cinematic conditions.
- Initial rejection due to the elimination of low-skilled jobs.
- Low availability of suppliers with specific developments.
- Lack of qualified and experienced resources to carry out the transformation (especially in smaller companies).



*Disadvantages of robotics. Source: <https://www.istockphoto.com/>*

## 1.3. IMPACTS OF ROBOTICS

On **productivity and competitiveness**:

- The results obtained enhance human capacity (by improving the speed of execution, quality and errors).
- Greater reliability and safety in repetitive tasks is provided, helping to improve the productivity and competitiveness of companies.

According to the MCKINSEY GLOBAL INSTITUTE, it is estimated that at least 50% of known activities are automatable with current systems and their progress will improve productivity by 0.8%-1.4% per year.

Other impacts, such as **employment, research** and other fields:

- In those countries where the number of robots per worker is higher, **employment** is higher and unemployment is lower. In terms of global digitalisation, it is expected that 36% of employment in Spain will be digitalised, 47% in the US and 59% in Germany.
- Robots are increasingly being used for **research** tasks (analysis), significantly reducing response times.
- In addition, robotics is having a significant impact on various aspects of society, such as demographics, the competitive level of countries, the workforce, the environment, healthcare and household chores.

## 1.4. CURRENT AND FUTURE SITUATION

Advanced automation applications are addressed to flexible manufacturing, cyber-physical systems use and advanced sensors use. Regarding collaborative robots, its current main application is assisting the operator in the assembly of parts, being still a technology that does not have a high cadence or possibilities to move high weights.

Traditionally, industrial robots are defined by specific characteristics, such as high mechanical performance or work in closed/fenced environments. They also require a specific programming and are designed for intensive production applications.

Collaborative robotics offers a new approach to robots sharing a workplace with people. Robots have sensory systems that allow them to learn about and interact with their environment, are easier to program and do not require safety fences.

Trends in collaborative robotics suggest that equipment with a higher payload capacity and longer range will be used, although using higher power will limit the speed to operate safely. Higher speed means a decrease in the ability to react when sensors detect a potential collision. Thus new sensor technologies are being investigated.

## 2. TYPES OF INDUSTRIAL ROBOTS

There are different ways of classifying robots. Based on mechanical configuration, they can be classified into:

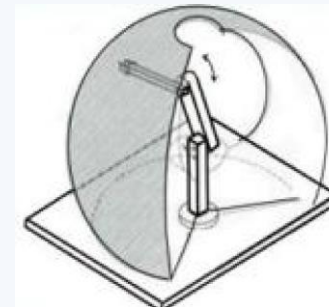
- **Cartesian robots:** linear motion by sliding on its three perpendicular axes (x, y, z planes).
- **Articulated robots:** a rotary shaft on a base link. The arm has one joint and only moves in one single plane. It contains a sliding axis at the end that operates in the z plane. i.e.: SCARA (Selective Compliant Articulated Robot Arm).
- **Anthropomorphic robots:** their configuration resembles that of the human arm. Made up of shoulder, elbow, and wrist joints.
- **Delta robots:** parallel link robots with three degrees of freedom. Based on parallelograms.
- **Collaborative robots:** industrial robots intended for direct human interaction in a cooperative workspace. A security space is not needed, as in the case of a conventional robot.



*Cartesian robots*



*Articulated robot. Scara type robot.*



*Anthropomorphic robot*



*Delta robot*

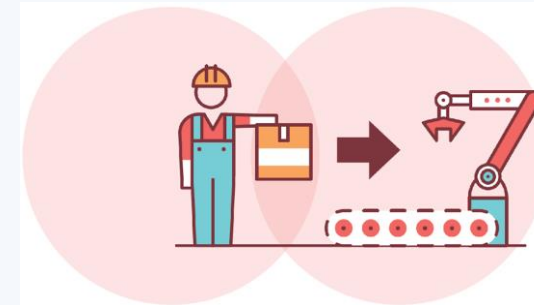
*Types of robots based on their configuration. Source: Automation and Robotics State of Art. Xunta de Galicia 2017*



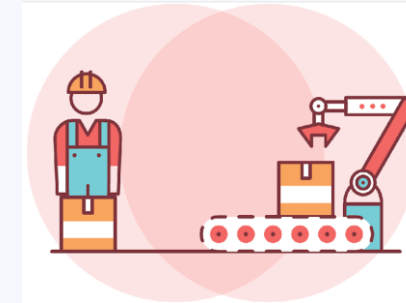
## 2. TYPES OF INDUSTRIAL ROBOTS

**Within collaborative robots**, there may be different levels of human-robot interaction, depending on time and space parameters. The cases shown are not mutually exclusive. It is estimated that complete collaborative applications will be a minority, and operations will typically involve some level of collaboration.

- **Cooperation (indirect collaboration)**: common workspace, no shared working time (e.g. alternating different tasks on the same workpiece).
- **Coexistence**: shared working time, separate workspace (e.g. different workpiece and space).
- **Direct collaboration**: shared workspace at a time (e.g. simultaneous task on the same product).



*Cooperation*



*Coexistence*



*Direct collaboration*

*Human-robot interaction levels. Source: Industrial robots and cobotson occupational hazard prevention*

### 3. CONSIDERATIONS AND BENEFITS OF ROBOT DEPLOYMENT

#### INTEGRATION OF A ROBOT

There are some key considerations for deploying robots:

- Defining requirements, such as the type of task, parts or cooperation modes.
- Forecast from the outset considering all the stakeholders (manufacturer, assembler, engineering).
- Change management in the company.

Some considerations must be taken into account to consider the interest of the installation and the efficiency of the investment:

- A minimum volume of parts to be produced by the robot is required (similar parts, reasonable set-up-programming time).
- Storage capacity: ensure a constant flow of automatic production before and after the machines.
- Required handling time determined by the path and the maximum robot speed in linear and angular movements.
- Machine layout: versions of robots with different specific degrees of freedom to suit the process.
- Accessibility to operation points: access to the machine where a part will be left or where an operation point will be performed.
- Operational supervisors: to program and perform the adjustment and maintenance of the robot, as well as to supervise its operation.
- Implementation costs in purchases. Costs for safety elements, support, fixtures, etc. Training costs.

### 3. CONSIDERATIONS AND BENEFITS OF ROBOT DEPLOYMENT

#### INDUSTRIAL ROBOT OR COBOT?

Both types of robots are conceived to share the production plant.

Cobots are efficient in tasks, such as material handling or product packaging. They interact with operators in a shared workspace and become their co-workers. Cobots are designed to work with them.

They are small, light and work at a slower speed when in collaborative mode. Therefore, they have less capacity to handle heavy parts and are less productive for manufacturing large (repetitive) series.

Combining their tasks with those carried out by the operator results in a synergy that is their greatest contribution. While cobots handle heavier tasks, operators perform lighter and more creative ones.

Cobots are safe, as they use sensors and software that allow functions to be implemented without a safety enclosure.



### 3. CONSIDERATIONS AND BENEFITS OF ROBOT DEPLOYMENT

#### INDUSTRIAL ROBOT OR COBOT?

##### SPECIFIC ADVANTAGES OF USING INDUSTRIAL ROBOTS

- **Productivity:** high speed and low production cycle times. Less steps on the processes.
- **Usage:** higher use of available machines.
- **Flexibility:** customised production through programming and adaptation of accessories. Production of a wide range of parts.
- **Cost reduction:** decrease of defective parts, contribution to raw material savings, etc.
- **Quality improvement:** high quality through increased predictability and repeatability of manufacturing results.
- **Greater work quality:** people can take on more value-added tasks.
- **Physical safety:** automation of hazardous tasks to avoid high temperatures, gases, etc.
- **Reduction of unhealthy jobs:** for example, exposure to noise, vibration, temperatura or chemicals.
- **Improvement of ergonomics:** tasks with a high physical load, repetitive or awkward motions, and so on.



Industrial Robot. Source: <https://www.istockphoto.com>

### 3. CONSIDERATIONS AND BENEFITS OF ROBOT DEPLOYMENT

#### INDUSTRIAL ROBOT OR COBOT?

#### SPECIFIC ADVANTAGES OF USING COBOTS

- **Wider range of automatable tasks:** used in cases where full automation is not feasible or not cost-effective.
- **Human-cobot partnership:** assigning low-value tasks (like repetitive or heavy tasks) to the robot and higher-value tasks to the operator.
- **Greater productivity due to human-cobot synergy:** efficient distribution of tasks with a positive impact on final productivity.
- **Less layout changes involved:** smaller size and easy location on the production lines.
- **Easy to program:** more intuitive and non-expert oriented control and programming systems.
- **Less dependence to technology suppliers:** easier reprogramming by the user.
- **Lower costs and faster ROI:** they are cheaper and the return of investment is faster.
- **Production customisation:** they are more flexible when it comes to making changes to production lines.



Collaborative robot. Source: <https://www.istockphoto.com>



## 4. SAFETY AND OCCUPATIONAL RISK PREVENTION

### 4.1. SAFETY MEASURES FOR INDUSTRIAL ROBOTS

#### DEVICES FOR ROBOTS AND ROBOT SYSTEMS

Industrial robots security is based on isolation and detection concepts:

- **Manual modes:** used by specialists for programming and setting outside the safety enclosure.
- **Safety function control systems:** level d from PL performance, according to their reliability and fault detection (based on EN ISO 13849-1 standard).
- **Safety-rated monitored robot control systems:** reduced speed, motion restriction, safety stop, force limiting.
- **Protective stop:** activation of devices, such as door protection interruption or light beams.
- **Emergency stop:** visible and accessible from each control point and from the access points to the space.
- **Limitation devices:** limiting movements in the restricted spaces defined at the risks evaluation.
- **Validation devices:** they allow the functioning of the equipment while remaining manually actioned.
- **Guidance console:** for programming or moving the robot.



*Console. Source: Kuka*

## 4. SAFETY AND OCCUPATIONAL RISK PREVENTION

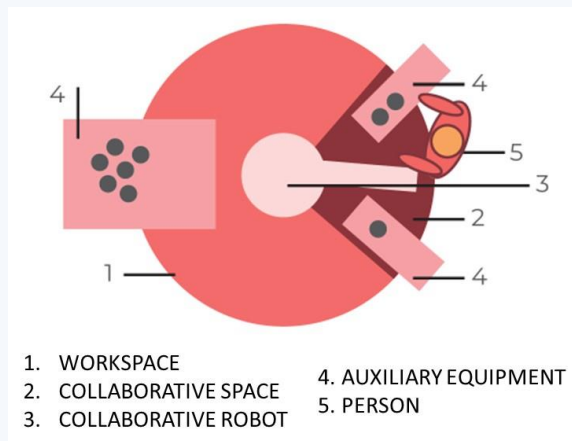
### 4.2. SAFETY IN THE DESIGN OF COLLABORATIVE ROBOTS' APPLICATIONS

The key process in design is risk assessment and risk mitigation with protective measures.

#### RISKS ASSESSMENT

Factors:

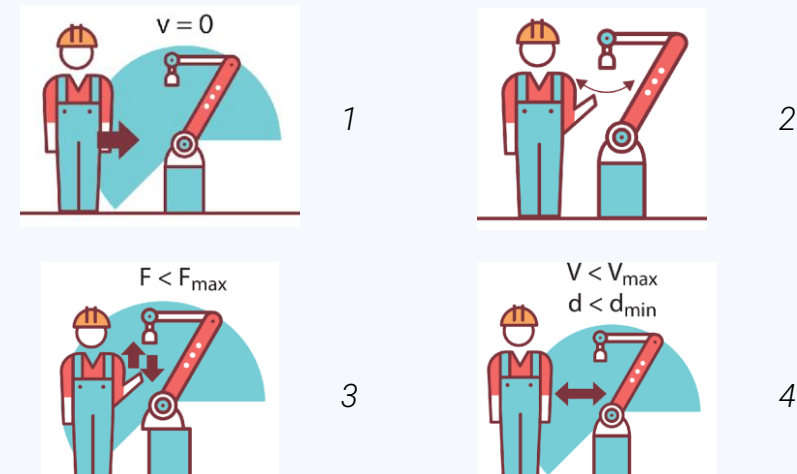
- Space limitation.
- Clear access and environments.
- Ergonomics and control interface.
- Using limits.
- Transitions (time constraints).



Risk assessments. Source: Technical standard ISO/TS 15066

Collaborative mode: ISO/TS 15066 specifications define four modes of collaborative operation and their safety measures:

1. Safety-rated monitored stop.
2. Hand guiding.
3. Power and force limiting.
4. Speed and separation monitoring.



Collaborative mode. Source: Industrial robots and cobots on occupational hazard prevention

## 4. SAFETY AND OCCUPATIONAL RISK PREVENTION

### 4.3. SAFETY, HYGIENE AND ERGONOMICS

#### Security:

- **Mechanical contact:** by accessing to hazardous parts during operation, adjustment/programming, cleaning/maintenance tasks, the robot exceeding its motion range during collaborative functioning.
- Discharge of material during the process.
- Thermal hazards: skin burns, inflammable environment, metallic dust, etc.
- Electrical risks: contact and skin burns during routine maintenance.

#### Hygiene:

- Vibrations exposure during hand guiding.
- Radiations exposure (ionizing and non ionizing).
- Presence of hazardous products from process.
- Noise exposure.
- Magnetic fields exposure.

#### Ergonomics:

- Repetitive movements from hand-arm system, handling of parts, etc.
- Overexertions and unnatural positions.

## 5. CHALLENGES

### MYTHS ABOUT AUTOMATION

There are some preconceived ideas about robot incorporation, without any solid basis.

- No reliability: robots also make mistakes, most commonly due to poor quality input data.
- They will replace humans.
- Secure productivity: it is not guaranteed and requires process changes and resource planning.

Robots and humans must cooperate in order to take advantage of each other: flexibility-experience (humans) and capability-precision (robot).

### COLLABORATIVE ROBOTS: PARADIGM OF SECURITY

New ways of presenting mechanical contact risks. In some cases, cobot-operator contact is allowed, moving away from the classic paradigm of protection, isolating danger through physical or other barriers.

### NORMATIVE GAP

The impact of technology on business and people must be assimilated and integrated through appropriate standards.

### CHANGES IN THE WORKPLACE

Particular attention shall be paid to ergonomic design, especially with regard to the pace of work and the postures adopted by operators.

## 5. CHALLENGES

### **CYBERSECURITY**

Security measures shall ensure robustness to potentially hazardous events.

### **TRENDS, ASPECTS TO RESOLVE AND IMPROVE**

- High implementation in welding, assembly, palletising, packaging and logistics processes.
- Future trends towards intervention in emergencies/disasters, research, healthcare, assistance and domestic tasks.
- Limitations in their autonomy due to high power consumption for their mobility, use of sensors and artificial vision systems, among others.
- Limitations in terms of adoption: by companies and their staff regarding training, ROI and capacity management.

### **INCREASINGLY FLEXIBLE SYSTEMS.**

On demand and customisation oriented.

Massive customisation:

- Quality
- Efficiency
- Customisation

A significant coexistence of industrial and collaborative robots is foreseen.



## 5. CHALLENGES

### ROBOTS' FEATURES

- Some desirable features in robots are not only efficiency, but simplicity, friendliness and ability to communicate.
- One might think that humanoid-looking robots would be more appropriate, but on a psychological level, they seem to generate rejection.
- Acceptance occurs as long as robots remain as equipment under control and for human service.
- Success depends on the predictability of each of the cobot steps.

### NEW SKILLS FOR JOB PROFILES ARE REQUIRED

- Knowledge and familiarity with new technologies, especially in the different programming systems and robot brands.
- The most in-demand profiles are engineers, robotics experts, programmers and software and application developers.

### ETHICS AND ROBOTS

- (1) A robot may not injure a human being, (2) a robot must obey orders given it by human beings and (3) a robot must protect its own existence as long as such protection does not conflict with the First or Second Law (Asimov, 1942).

The European Parliament's Legal Affairs Committee proposed legislation oriented to: robots increase, protection against harm, ethics in data/information management, ensuring equal access to progress in robotics.



*Ethics and robots. Source: Industrial robots and cobots on occupational hazard prevention*

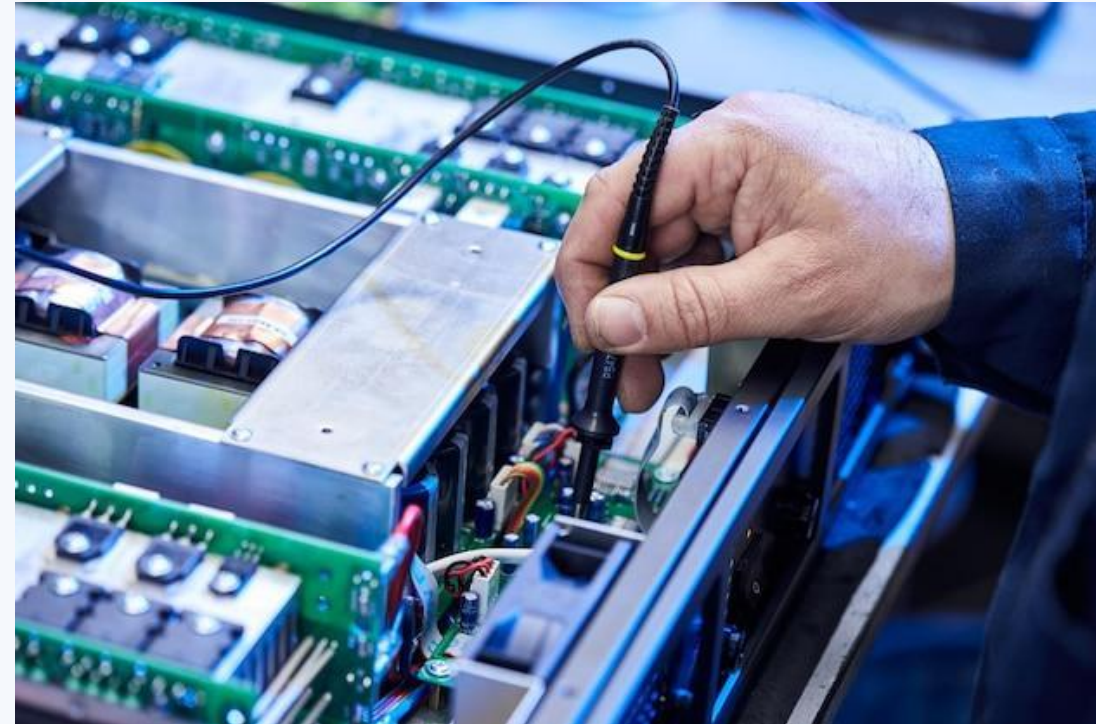
## 6. INDUSTRIAL APPLICATIONS

### **Robots implementation process demands:**

- A detailed previous study of the process.
- Advantages and disadvantages of introducing robots.
- Be willing to accept changes in the original process.
- Changing parts, designs, etc.
- Likelihood of them requiring systems substitution.

### **Regarding the type of robot to be used, some factors shall be taken into account:**

- Workspace.
- Load speed.
- Control capacity.
- Costs.
- Etc.



## 6. INDUSTRIAL APPLICATIONS

### MOULDING

Injection moulding was the first robotised process (1960). In moulding, robots are used in:

- Melting parts from the mould and transferring them to other stages of the process, such as the cooling stage.
- Moulds cleaning and maintenance.
- Placement of parts inside the moulds.

If loads handled are medium/high size, great accuracy is not needed and the field of action must be large.

### WELDING

Spot welding is the most frequent robotised task in multiple sectors. Robotisation has two solutions:

- The robot transports the workpiece to the welding system.
- The robot transport the welding clamp and positions it at the exact spot to be welded.

There are special robots that integrate the welding system programming.



*Moulding. Source: Robotics applications*



*Welding. Source: Robotics applications*

## 6. INDUSTRIAL APPLICATIONS

### MATERIALS APPLICATIONS

- Surface finishing, such as painting, varnishing, and metal particles.
- Using robots for painting is widespread in the manufacturing of automobiles, appliances, furniture.
- Environments for finishing processes are hazardous, so they are particularly suitable for robotisation.
- Painting robots are specific (articulated, light and with 6 degrees of freedom to paint without limitations).
- Continuous trajectory module is needed (specifying the starting-/endpoint is not enough).
- The most common method is learning by continuous sampling trajectory (defined by the operator).



*Materials applications. Source: Robotics applications*

### ADHESIVES AND SEALING APPLICATIONS

- Application of sealing materials and adhesives (automotive sector).
- The liquid material (in a tank) is pumped towards the applicator gun that the robot carries.
- The robot follows the programmed trajectory.
- Synchronised control of the robot speed with the flow of material supplied by the gun is required.
- It is common for the robot to be suspended.



## 6. INDUSTRIAL APPLICATIONS

### MACHINE TENDING

- Specialised machine tending is a widespread robotised task.
- Hazardousness, physical efforts and repetitive tasks have led a wide range of companies to introduce robots in their facilities.
- In addition to a greater positioning accuracy of the robot, an ability to control the machine and other auxiliary devices is added.
- Robots of low complexity, medium precision, reduced number of degrees of freedom and simple control are generally used.
- In the last few years, there is significant increase in the application of the robot to flexible machining cells (machining plants). Robots are a valuable complement to these machines, tackling tasks such as loading, unloading, transporting, or feeding tools.



*Machine tending. Source: Robotics applications*



## 6. INDUSTRIAL APPLICATIONS

### PROCESSING

- Operations in which robots deal with parts and tools in order to modify the shape of the parts.
- For example, in deburring (the process of removing burrs), the robot takes the tool and a part depending on the application, and bring both into contact.
- Continuous trajectory control robots are required, as great accuracy is needed.
- Robots should include sensors, so that they adapt to the irregular shapes of the piece to be deburred.
- Polishing application is very similar and the use of robots here is also widespread. Sensors could be less precise here.

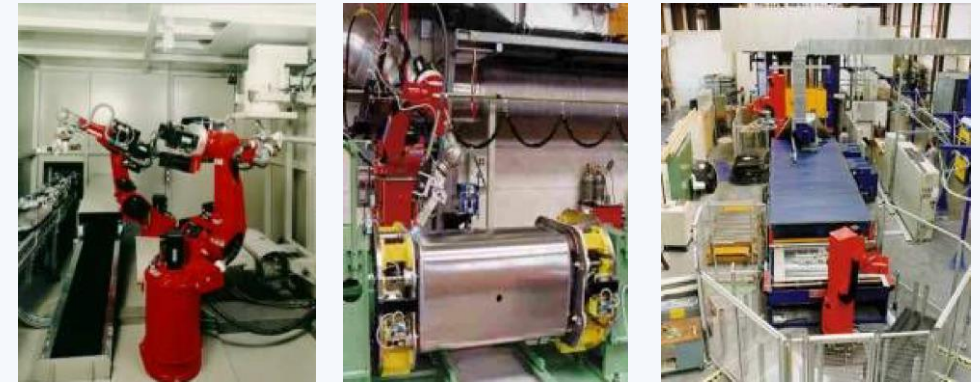


*Processing. Source: Robotics applications*

## 6. INDUSTRIAL APPLICATIONS

### CUTTING

- Robots are appropriate for carrying cutting tools above the pieces to be cut off.
- When it comes to methods such as oxy fuel, plasma, laser and waterjet cutting, the robot transports the nozzle through which the cutting fluid exits.
- Pieces to be cut can be displayed in various layers, cutting them simultaneously.



*Cutting. Source: Robotics applications*

### ASSEMBLY

- As great precision and ability are needed in assembling tasks, automation here is challenging.
- In consequence, multiple research and R&D projects are being conducted in order to reduce assembly costs.
- For repetitive assembly tasks that do not require high loads, SCARA robots are being used.
- Cartesian robots are also used because of their precision and adaptability.



*Assembly. Source: Robotics applications*

## 6. INDUSTRIAL APPLICATIONS

### PALLETISING

- For the arrangement of pieces on a platform or tray, there is a whole range of specific machines whose main value is speed and cost, but are rigid in terms of operation, being unable to modify loading/unloading.
- Robots become advantageous in applications in which the shape, number or features of products are often variable.
- Tasks involve handling of large loads, weight and dimensions. As a consequence, great size robots are used in this case.
- In a pick and place process, the robot pick parts from one place and place them on another. Tasks involved range from moving parts in pre-set positions to others where the robot requires external sensors, artificial vision or touch, to determine the pick-up position and placement. In picking tasks, weight involved is usually light (<5 kg).



*Palletising. Source: Roboticsapplications*

## 6. INDUSTRIAL APPLICATIONS

### QUALITY CONTROL

- Robots are able to perform multiple quality control processes using their positioning and material handling abilities. For example, dimensional control for manufactured parts can be verified with a probe.
- Robots can also be used to transport measuring instruments (such as ultrasound, x-ray) to points on the part to be examined.
- In addition, the robot can perform sorting tasks between correct/incorrect parts using artificial vision systems.
- Cartesian and articulated robots are being used for these activities, as specific robots do not exist yet.

### HANDLING IN CLEAN ROOM ENVIRONMENTS

- Some handling processes must be done in clean and controlled environments.
- In such places, operator tasks get complicated as strict control measures are needed, e.g. impurities control.
- Examples are clean rooms in pharmaceutical industry or in semiconductor production.
- In order to maintain clean environments, robots are permanently placed in a cabin.
- It results in a reduced risk of contamination and manufacturing costs, and a homogeneous product quality.



*Cleanrooms. Source: Robotics applications*

## 7. ROBOTICS ACROSS THE WORLD AND IN THE FURNITURE SECTOR

### NEW APPLICATIONS SECTORS

While automation or manufacturing have been using robots for 30 years, such technology is considerably expanding, even in sectors where high productivity, repetitive tasks or a detailed understanding of the environment are not required. Examples can be found in:

- Agriculture and forestry sectors
- Aid for disabled people
- Building sector
- Household sector
- Hazardous environments
- Space industry
- Healthcare and medicine
- Mining sector
- Marine and offshore industry
- Surveillance and security
- Telepresence

In general, the application of robotics to these sectors is characterised by the lack of structuring both the environment and the task to be performed, and the lesser importance of economic profitability criteria as opposed to performing tasks in dangerous environments or where human access is not possible. These features make service robots have a greater degree of intelligence, as sensors or appropriate software are required in order to make quick decisions.



## 7. ROBOTICS ACROSS THE WORLD AND IN THE FURNITURE SECTOR

### AUTOMOTIVE

- PSA (Vigo-Spain): large-scale project to deploy cobots for tasks of different nature.
- COPO e IZMAR. ROBERTO project (Galicia-Spain): development of cobots with a high load capacity (current standard: >10 kg).
- FAURECIA: auxiliar automobile company with big deployments of cobots and AGV (automated guided vehicles).
- CONTINENTAL: implementation through UR10 cobots to automate the manufacturing and handling of polycrystalline plate, reducing setup to >50%).
- FORD (Colonia-Germany): cobots in the shock-absorbing installation process. Project in collaboration with KUKA Roboter.



*Collaborative robots. Source: Automation and Robotics State of Art. Xunta de Galicia, 2017*

## 7. ROBOTICS ACROSS THE WORLD AND IN THE FURNITURE SECTOR

### AERONAUTICS INDUSTRY

- TORRESLAYUP: 11-axis gantry-type CNC taping machine for high-speed taping of aircraft structural components made of composite materials. Mtorres company.
- FLEXIBLE DRILLING HEAD (FDH): 5-axis progressive drilling/riveting robot, self-contained, portable and autonomous. Mtorres company.
- FUTURASSY: semi-humanoid cobot with the ability to grip parts, according to the operator requirements. Airbus corporation.
- AIR-COBOT: collaborative mobile robot for aircraft inspections using sensors. Airbus corporation.



*Torreslayup. Source: Automation and Robotics state of Art .  
Xunta de Galicia 2017*



*Futurassy. Source: Automation and Robotics state of Art . Xunta  
de Galicia 2017*

## 7. ROBOTICS ACROSS THE WORLD AND IN THE FURNITURE SECTOR

### AGRO-FOOD AND ORGANIC INDUSTRY

Robots are used in this sector in order to improve quality, productivity, efficiency and food safety. Specially used for packing and palletising. It can be highlighted the BLUE FISH project: robotics and artificial vision development for sorting operations in the canning industry. Tacore industry.

### RENEWABLE ENERGIES

Robots are used beyond making the product and are mainly used in the maintenance of the equipment once they have been installed. For instance, there are already robots for cleaning solar panels or for wind turbines maintenance.



*A robot for solar panels cleaning.  
Source: KICT*



*A robot for wind turbines maintenance.  
Source: TSR WIND*

## 7. ROBOTICS ACROSS THE WORLD AND IN THE FURNITURE SECTOR

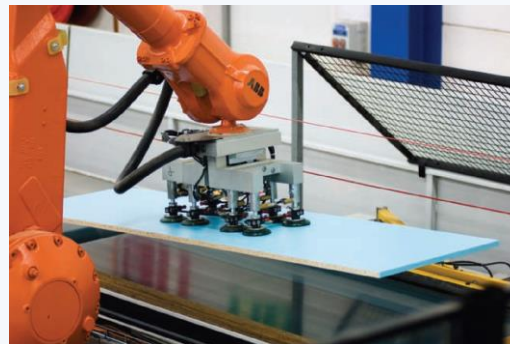
### FURNITURE INDUSTRY

There are diverse automation solutions for the furniture industry that significantly contribute to improve productivity and product availability. This sector is particularly taking advantage of the use of complete automated production lines, which turns into precision and a quick return of investment. It is proved that robots are widely beneficial for the furniture and wood sector, including higher levels of production, better quality in processes and products, and higher efficiency and flexibility, among other improvements.



### MATERIAL HANDLING, MACHINE MAINTENANCE AND ASSEMBLY

Flexible, efficient and suitable robots for general product handling, loading and unloading of machinery, palletising, depalletising and assembly. Robots offer exceptional high positional accuracy (0.05 - 0.08 mm), ensuring maximum quality. Up to four robots with a single control module are used, leading to significant savings in clear, easy-to-manage workspace.



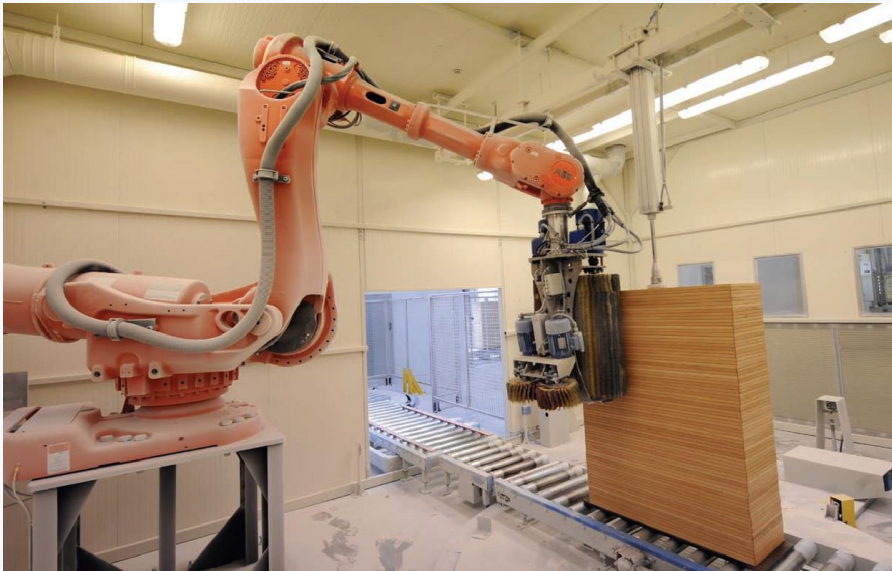
*Material handling. Source: Efficient robot-based automation for the wood industries. ABB*



## 7. ROBOTICS ACROSS THE WORLD AND IN THE FURNITURE SECTOR

### PICKING, PACKAGING AND PALLETISING

Packaging solutions with specialised robots. Handling and packaging of wood panels, flat-pack furniture, doors, windows, frames, flooring and other wood building materials. For example, FlexPicker (ABB) is ideal to pick up a wide range of products, as it incorporates a dedicated four-axle packer with a reach of 3.15 m and a payload of 250 kg.



*Picking, packing and palletising. Source: Efficient robot-based automation for the wood industries. ABB*



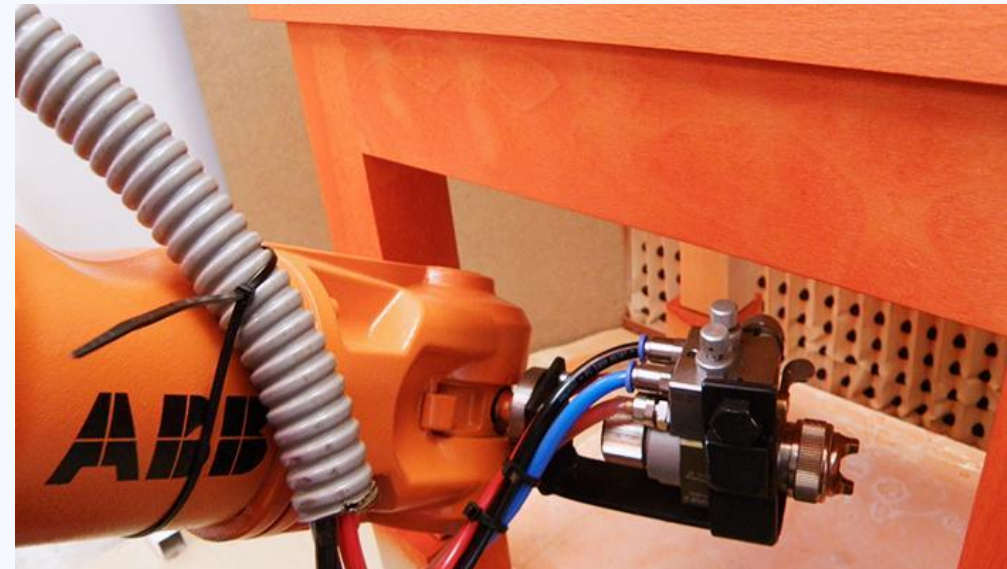
## 7. ROBOTICS ACROSS THE WORLD AND IN THE FURNITURE SECTOR

### PAINTING AND COATING

Manual finishing processes not always offer regular solutions. On the contrary, robotised solutions achieve maximum quality results helping to reduce consumption and material waste, with a great working envelope. Technology is flexible and versatile, and its high speed and precision offer reduced cycle times. Painting robots also include specific application systems that guarantee high quality finishing and savings.



*Painting. Source: Efficient robot-based automation for the wood industries. ABB*



*Painting. Source: <https://probot.es/sector-mueble/>*

## 7. ROBOTICS ACROSS THE WORLD AND IN THE FURNITURE SECTOR

### SANDING, POLISHING AND SURFACE FINISHING

Robotics machines offer specific solutions for automated sanding and polishing of wood parts and furniture. Current systems provide flexible solutions that can be quickly adapted with precision to different surfaces and materials consistency.



*Sanding, polishing and finishing. Source: Efficient robot-based automation for the wood industries. ABB*

### OTHER SECTORS

Wood often presents natural failures (knots, holes, bark pockets and other inconsistencies) that make it useless. Many manufacturers rely on vision systems to support robotic cells that are able to cope with changing environments, such as lightning or reflections. Vision-guided robotics allows automated operations that previously required humans, eliminating the need for expensive accessories. If force control systems for machining are available (Force Control FC), the robot is provided with the ability to adapt with precision to the consistency and the outline of the surface of the materials to process.

## 7. ROBOTICS ACROSS THE WORLD AND IN THE FURNITURE SECTOR

### REAL EXAMPLES:

- **Assembling the perfect flat pack: Svedplan, Sweden:** furniture manufacturer that uses nine ABB robots – four are depalletising robots and five are assembly robots. As a result, production has increased by 45% with a <3 years ROI. Workers attitudes have also changed, as the company have ensured their jobs.
- **Efficient low-cost production: Swedwood International:** Swedwood International (IKEA Group) has multiple robotics solutions for its 35 facilities: painting, packaging, palletising, as well as IRC5 controllers, PickMaster software and advanced guided-vision technologies.



*Assembling the perfect flat pack: Svedplan, Sweden. Source: Efficient robot-based automation for the wood industries. ABB*



*Efficient low cost production: Swedwood International. Source: Efficient robot-based automation for the wood industries. ABB*

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# Fostering diGitalisation and blonic transformation of SMEs through the development of a novel and innovative Training material for overcoming COVID-19 crisis

[HTTPS://GIST-PROJECT.EU/](https://gist-project.eu/)



**Thank  
you**



# TU.1

# LU.5

**TRAINING UNIT 1 – I4.0 TECHNOLOGIES**

**LEARNING UNIT 5 – CLOUD SERVICES**



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## 1. Introduction to Cloud computing

### 1.1. What is Cloud Computing?

## 2. Introduction to Cloud Services

### 2.1. Cloud services overview.

### 2.2. Cloud services Types

- Infrastructure-as-a-Service (IaaS)
- Platforms-as-a-Service (PaaS)
- Software-as-a-Service (SaaS)
- Function-as-a-Service (FaaS)

### 2.3. Choosing among IaaS, PaaS and SaaS

## 3. Deployment Models

### 3.1. Public Cloud

### 3.2. Private Cloud

### 3.3. Community Cloud

### 3.4. Hybrid Cloud

### 3.5. Comparison table of top cloud deployment models

## 4. Practical Real Case



Cloud services. Source: <https://www.logicaldoc.com/blog/521-the-5-main-advantages-of-cloud-computing-in-the-smart-working-regime>

# 1. INTRODUCTION TO CLOUD COMPUTING

## 1.1. WHAT IS CLOUD COMPUTING?

Cloud Computing is shaping how we live and work today. Simply put, Cloud computing is the delivery of computing services over the internet (The Cloud) to offer faster innovation, flexible resources, and economies of scale. These include: servers, storage, databases, networking, software, analytics, Intelligence.

Cloud computing is a big shift from the traditional way businesses think about IT resources. Here are seven common reasons organizations are turning to cloud computing services:



### **COST**

Cloud computing eliminates the capital expense of buying hardware and software and setting up and running on-site datacentres—the racks of servers, the round-the-clock electricity for power and cooling, and the IT experts for managing the infrastructure. It adds up fast.

# 1. INTRODUCTION TO CLOUD COMPUTING

## 1.1. WHAT IS CLOUD COMPUTING?



### **SPEED**

Most cloud computing services are provided as self-service and on demand, so even vast amounts of computing resources can be provisioned in minutes, typically with just a few mouse clicks, giving businesses a lot of flexibility and taking the pressure off capacity planning.



### **GLOBAL SCALE**

The benefits of cloud computing services include the ability to scale elastically. In cloud speak, that means delivering the right amount of IT resources—for example, more or less computing power, storage, bandwidth—right when they're needed, and from the right geographic location.



### **PRODUCTIVITY**

On-site datacentres typically require a lot of “racking and stacking”—hardware setup, software patching, and other time-consuming IT management chores. Cloud computing removes the need for many of these tasks, so IT teams can spend time on achieving more important business goals.



# 1. INTRODUCTION TO CLOUD COMPUTING

## 1.1. WHAT IS CLOUD COMPUTING?



### PERFORMANCE

The biggest cloud computing services run on a worldwide network of secure data centres, which are regularly upgraded to the latest generation of fast and efficient computing hardware. This offers several benefits over a single corporate data centre, including reduced network latency for applications and greater economies of scale.



### SECURITY

Many cloud providers offer a broad set of policies, technologies, and controls that strengthen your security posture overall, helping protect your data, apps, and infrastructure from potential threats.



### RELIABILITY

Cloud computing makes data backup, disaster recovery, and business continuity easier and less expensive because data can be mirrored at multiple redundant sites on the cloud provider's network [1].

## 2. INTRODUCTION TO CLOUD SERVICES

### 2.1. CLOUD SERVICES OVERVIEW

Cloud services are infrastructure, platforms, or software that are hosted by third-party providers and made available to users through the internet.

Cloud services facilitate the flow of user data from front-end clients (e.g. users' servers, tablets, desktops, laptops—anything on the users' ends), through the internet, to the provider's systems, and back. Users can access cloud services with nothing more than a computer, operating system, and internet connectivity or virtual private network (VPN) [2].



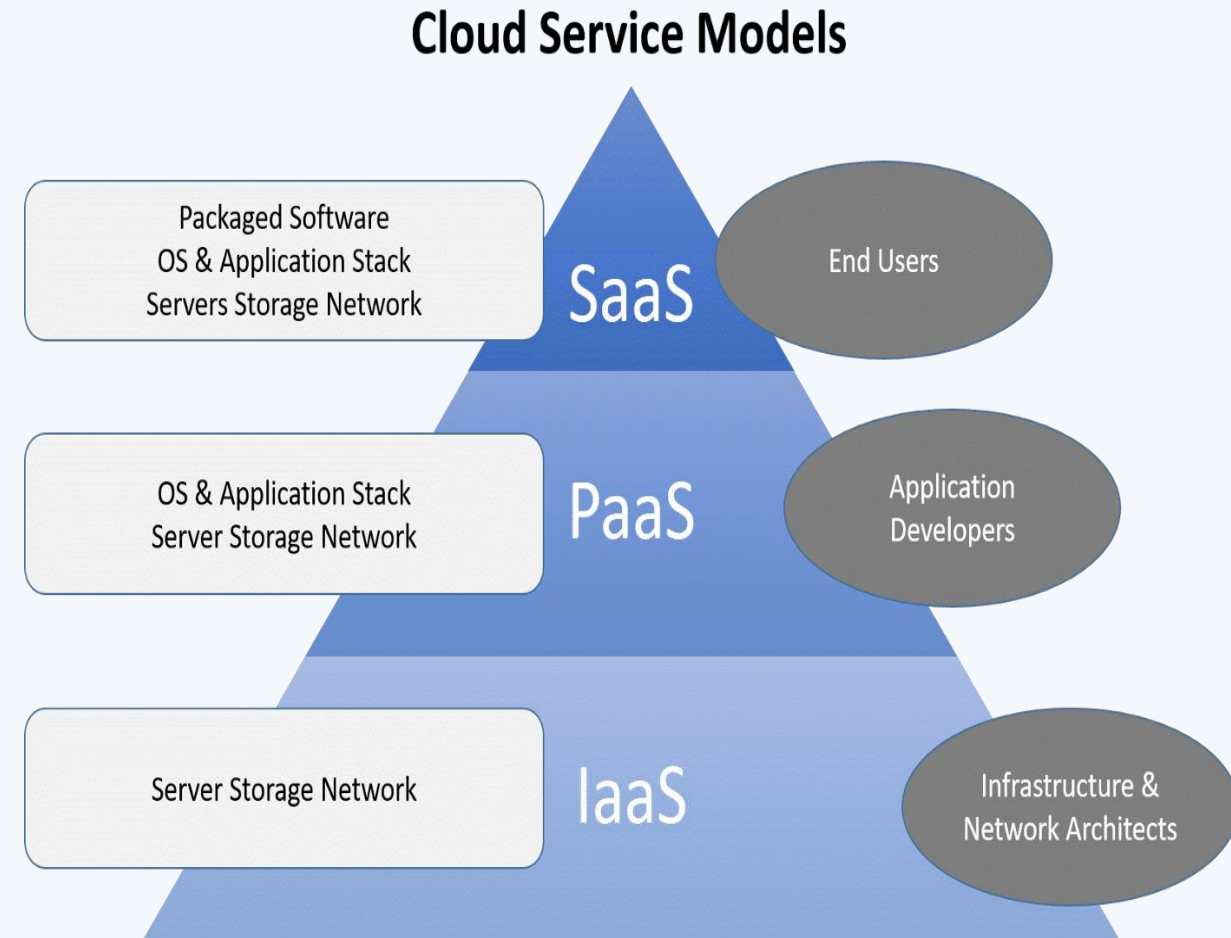
Frontend clients. Source: <https://www.thebalancesmb.com/why-cloud-computing-is-ideal-for-small-businesses-2948273>

## 2. INTRODUCTION TO CLOUD SERVICES

### 2.2. CLOUD SERVICES TYPES

The models of Cloud Computing refer to the set of services they can offer. There are three basic Cloud Computing services, which are: Infrastructure as a Service (**IaaS**), Platform as a Service (**PaaS**) and Software as a Service (**SaaS**). This range, respectively, from machine-related services (hardware), through development tools, to the more logical nature (software).

Depending on the needs of users, any type of cloud computing service is used either individually or in combination with others. These are also sometimes called the cloud computing "stack" because they build on top of one another [3].



Cloud Service Models. Source:  
<https://medium.com/@IDMdatasecurity/types-of-cloud-services-b54e5b574f6>

## 2. INTRODUCTION TO CLOUD SERVICES

### 2.2. CLOUD SERVICES TYPES

#### INFRASTRUCTURE-AS-A-SERVICE (IAAS)

Infrastructure-as-a-service (IaaS), also known as cloud infrastructure services, is a form of cloud computing in which IT infrastructure is provided to end users through the internet. IaaS is commonly associated with serverless computing.

In the IaaS model, users handle the applications, data, operating system, middleware, and runtimes.

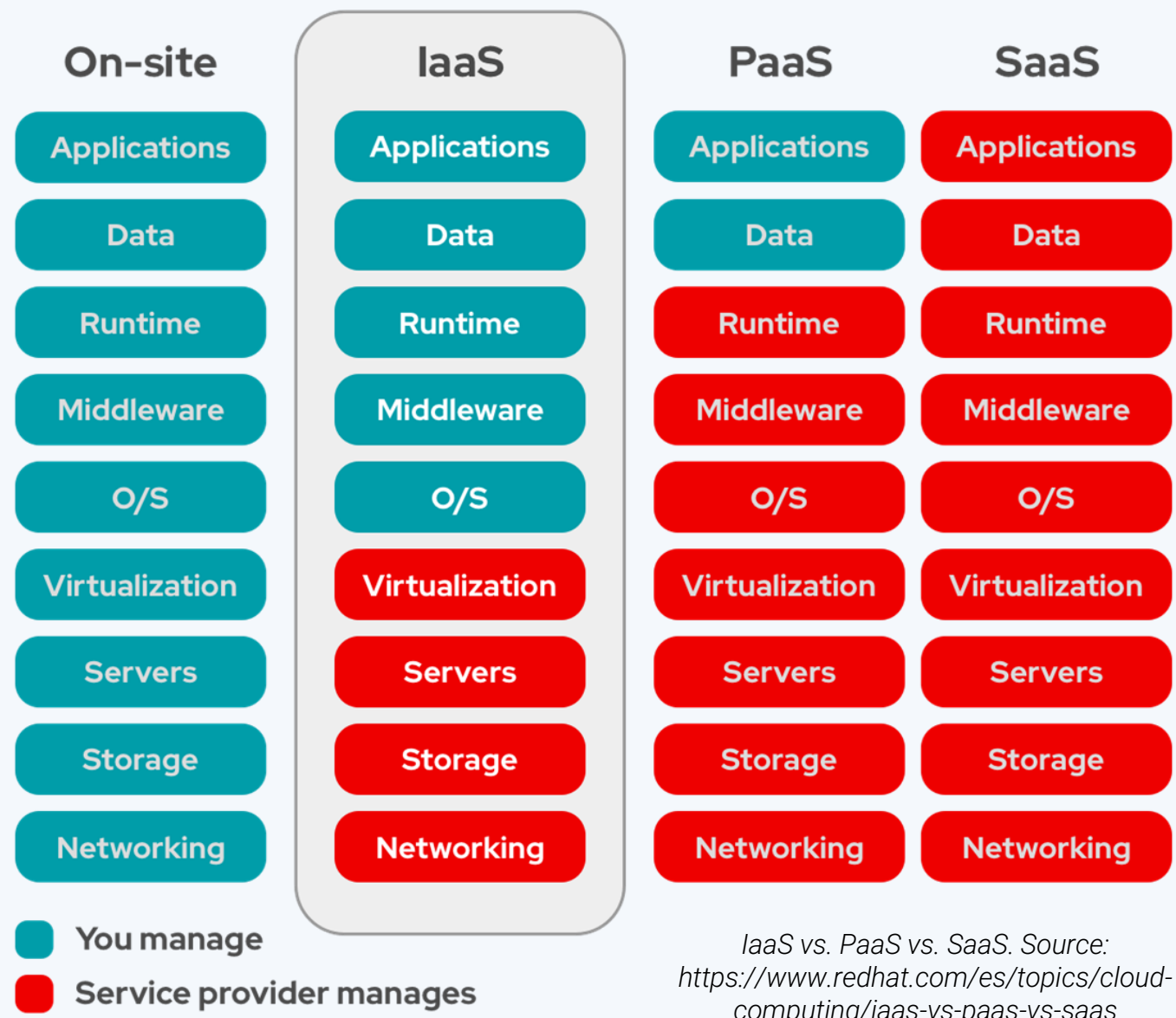
The IaaS vendor provides the virtualization, storage, network, and servers. This way, the user doesn't have to have an on-premise datacentre and doesn't have to worry about physically updating or maintaining these components themselves.

## 2. INTRODUCTION TO CLOUD SERVICES

### 2.2. CLOUD SERVICES TYPES

#### INFRASTRUCTURE-AS-A-SERVICE (IAAS)

In most cases, the IaaS user has complete control of the infrastructure through an application programming interface (API) or dashboard. As the most flexible as-a-Service cloud model, IaaS makes it easier to scale, upgrade, and add resources—like cloud storage—instead of having to anticipate future needs and pay costs up front [4].



IaaS vs. PaaS vs. SaaS. Source:  
<https://www.redhat.com/es/topics/cloud-computing/iaas-vs-paas-vs-saas>



## 2. INTRODUCTION TO CLOUD SERVICES

### 2.2. CLOUD SERVICES TYPES

#### PLATFORMS-AS-A-SERVICE (PAAS)

Platform-as-a-service (PaaS) is a form of cloud computing where hardware and an application software platform is provided by another party. Primarily for developers and programmers, a PaaS allows the user to develop, run, and manage their own apps without having to build and maintain the infrastructure or platform usually associated with the process.

Most cloud services offer Kubernetes<sup>1</sup>-based platforms as a service — that is, as explicit Platform-as-a-Service (PaaS) or Infrastructure-as-a-Service (IaaS) environments. This lets Kubernetes function as the platform on which container-based applications can run, scale, and be managed.

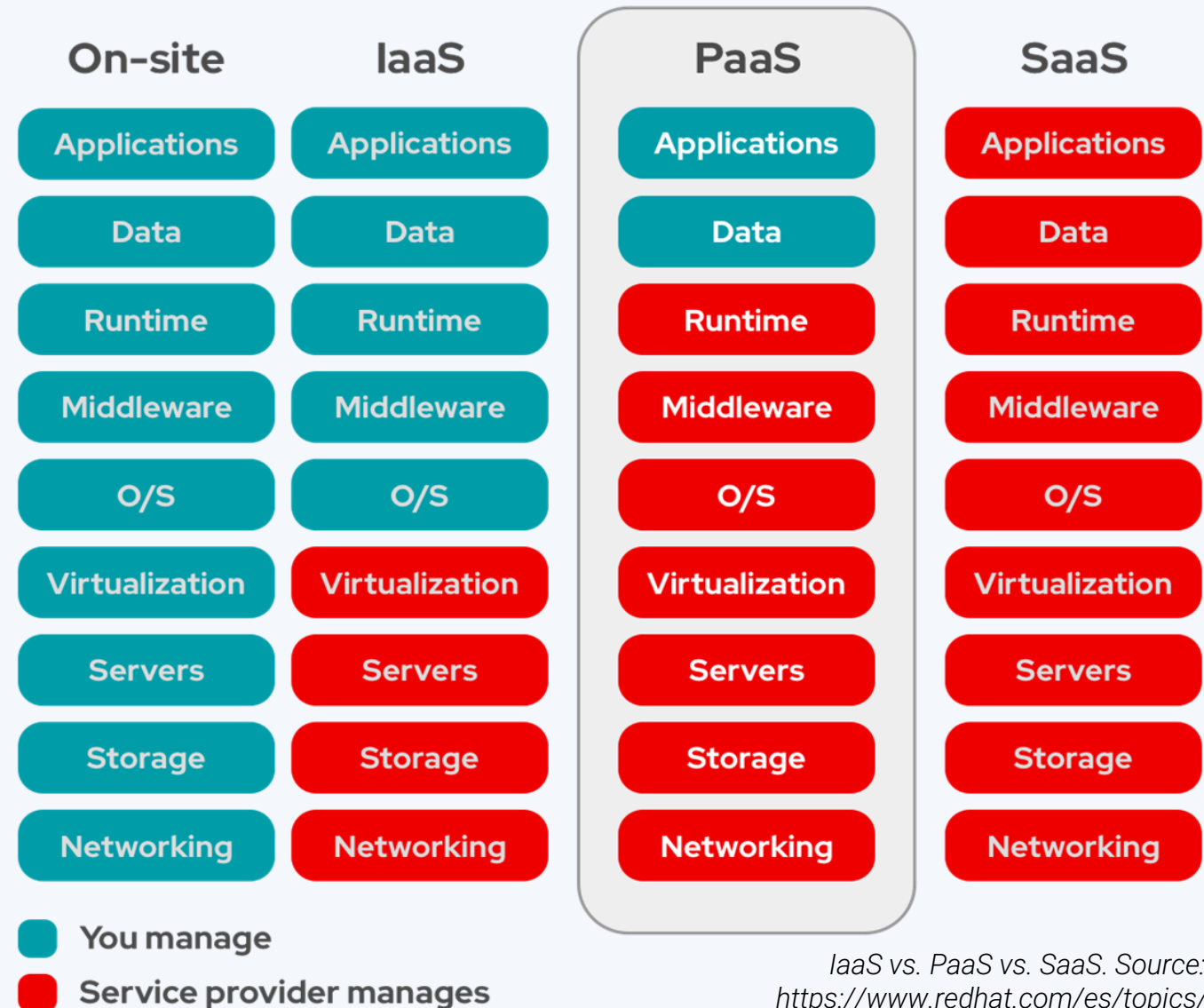
<sup>1</sup>Kubernetes is a portable, extensible, open source platform for managing containerized workloads and services, that facilitates both declarative configuration and automation.

## 2. INTRODUCTION TO CLOUD SERVICES

### 2.2. CLOUD SERVICES TYPES

#### PLATFORMS-AS-A-SERVICE (PAAS)

A PaaS provider hosts the hardware and software on its own infrastructure and delivers this platform to the user as an integrated solution, solution stack, or service through an internet connection [5].



*IaaS vs. PaaS vs. SaaS. Source:*  
<https://www.redhat.com/es/topics/cloud-computing/iaas-vs-paas-vs-saas>

## 2. INTRODUCTION TO CLOUD SERVICES

### 2.2. CLOUD SERVICES TYPES

#### SOFTWARE-AS-A-SERVICE (SAAS)

Software-as-a-service (SaaS) is a form of cloud computing that delivers a cloud application—and all its underlying IT infrastructure and platforms—to end users through an internet browser.

SaaS reduces users upfront costs by eliminating the need to permanently purchase software or invest in a robust on-premise IT infrastructure—as is the case with traditional software. SaaS customers should invest in fast network hardware, however, since service performance is determined by internet connection speeds.

SaaS applications take advantage of multitenant architecture to isolate customer data. Software upgrades, bug fixes, and other general app maintenance are taken care of by the SaaS provider, while users interact with the software through a web browser.

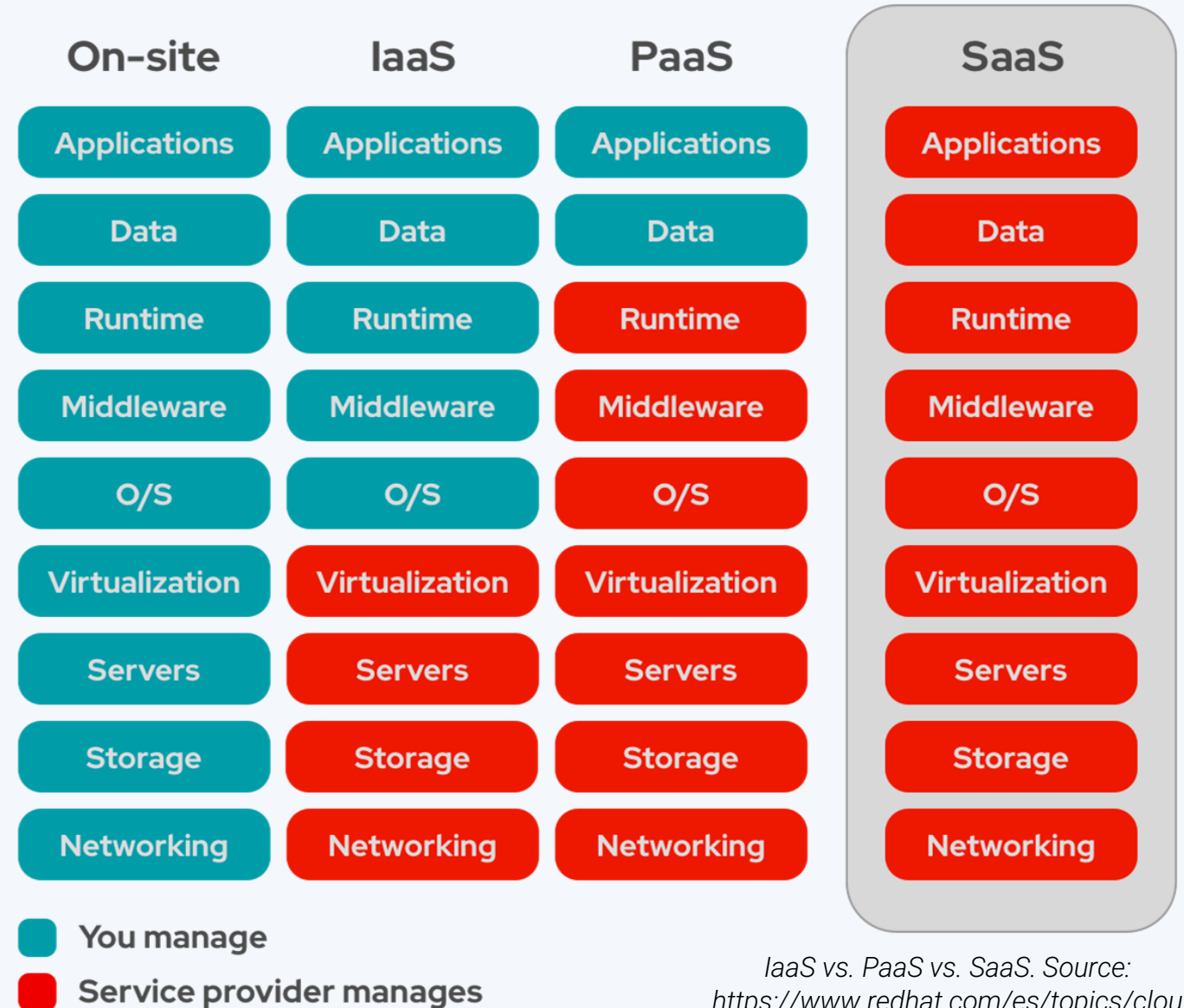
## 2. INTRODUCTION TO CLOUD SERVICES

### 2.2. CLOUD SERVICES TYPES

#### SOFTWARE-AS-A-SERVICE (SAAS)

Most SaaS applications are preconfigured plug-and-play products where the SaaS provider manages everything behind the app, including:

- Hardware components, like networking, storage, and datacentre servers.
- Platforms, like virtualization, the operating system, and middleware.
- Software requirements, like runtimes, data, and the app itself [6].



IaaS vs. PaaS vs. SaaS. Source:  
<https://www.redhat.com/es/topics/cloud-computing/iaas-vs-paas-vs-saas>

## 2. INTRODUCTION TO CLOUD SERVICES

### 2.2. CLOUD SERVICES TYPES

#### FUNCTION-AS-A-SERVICE (FAAS)

Function-as-a-Service, or FaaS, is a kind of cloud computing service that allows developers to build, compute, run, and manage application packages as functions without having to maintain their own infrastructure.

FaaS is an event-driven execution model that runs in stateless containers and those functions manage server-side logic and state using services from a FaaS provider.

FaaS solutions are available on major public clouds and can be provisioned on-premise, adding significant new capabilities to enterprise IT for app development.

FaaS is also a way to implement serverless computing where developers write business logic that is then executed in Linux containers fully managed by a platform.

FaaS gives developers an abstraction for running web applications in response to events, without managing servers. For example, uploading a file could trigger custom code that transcodes the file into a variety of formats.

FaaS infrastructure is usually metered on-demand by the service provider, primarily through an event-driven execution model, so it's there when you need it, but it doesn't require any server processes to be running constantly in the background, like platform-as-a-service (PaaS) would [7].



## 2. INTRODUCTION TO CLOUD SERVICES

### 2.3. CHOOSING AMONG IAAS, PAAS AND SAAS

Going through the details of what Saas, PaaS and IaaS may have given a general understanding of these three cloud models. Each of them differs and has a range of advantages and disadvantages. Obviously, the as-a-service solution a customer chooses depends first on the functionality the customer requires, and the expertise it has on staff.

It is convenient to highlight and know which is its specific field of action, in order to know when it is suitable to choose one option or another. For this we will highlight the main benefits and use cases of each service.

## 2. INTRODUCTION TO CLOUD SERVICES

### 2.3. CHOOSING AMONG IAAS, PAAS AND SAAS

#### IAAS

IaaS offers many **advantages**, including:

- The most flexible cloud computing model.
- Easy to automate deployment of storage, networking, servers, and processing power.
- Hardware purchases can be based on consumption.
- Clients retain complete control of their infrastructure.
- Resources can be purchased as-needed.
- Highly scalable.

## 2. INTRODUCTION TO CLOUD SERVICES

### 2.3. CHOOSING AMONG IAAS, PAAS AND SAAS

#### IAAS

IaaS may be the most beneficial option in several situations, including:

- **Startups and small companies** may prefer IaaS to avoid spending time and money on purchasing and creating hardware and software.
- **Larger companies** may prefer to retain complete control over their applications and infrastructure, but they want to purchase only what they actually consume or need.
- **Companies experiencing rapid growth** like the scalability of IaaS, and they can change out specific hardware and software easily as their needs evolve.

## 2. INTRODUCTION TO CLOUD SERVICES

### 2.3. CHOOSING AMONG IAAS, PAAS AND SAAS

#### PAAS

No matter the size of your company, using PaaS offers numerous **advantages**, including:

- Simple, cost-effective development and deployment of apps.
- Scalable.
- Highly available.
- Developers can customize apps without the headache of maintaining the software.
- Significant reduction in the amount of coding needed.
- Automation of business policy.
- Easy migration to the hybrid model.

## 2. INTRODUCTION TO CLOUD SERVICES

### 2.3. CHOOSING AMONG IAAS, PAAS AND SAAS

#### PAAS

Utilizing PaaS is beneficial, sometimes even necessary, in several situations. For example, PaaS can streamline workflows when multiple developers are working on the same development project. If other vendors must be included, PaaS can provide great speed and flexibility to the entire process. PaaS is particularly beneficial if you need to create customized applications.

This cloud service also can greatly reduce costs and it can simplify some challenges that come up if you are rapidly developing or deploying an app [8].



### 2.3. CHOOSING AMONG IAAS, PAAS AND SAAS

#### SAAS

The main **benefit** of SaaS is that it offloads all infrastructure and application management to the SaaS vendor. All the user has to do is create an account, pay the fee and start using the application. The vendor handles everything else, from maintaining the server hardware and software to managing user access and security, storing and managing data, implementing upgrades and patches and more. Other benefits of SaaS include:

- **Minimal risk:** Many SaaS products offer a free trial period, or low monthly fees that let customers try the software to see if it will meet their needs, with little or no financial risk.
- **Anytime/anywhere productivity:** Users can work with SaaS apps on any device with a browser and an internet connection.
- **Easy scalability:** Adding users is as simple as registering and paying for new seats; customers can purchase more data storage for a nominal charge [9].

## 2. INTRODUCTION TO CLOUD SERVICES

### 2.3. CHOOSING AMONG IAAS, PAAS AND SAAS

#### SAAS

Just as with IaaS and PaaS, there are specific situations when SaaS is most advantageous:

- Start-ups or small companies that need to launch e-commerce quickly and don't have time for server issues or software.
- Short-term projects that require quick, easy, and affordable collaboration.
- Applications that aren't needed too often, such as tax software.
- Applications that need both web and mobile access.

## 2. INTRODUCTION TO CLOUD SERVICES

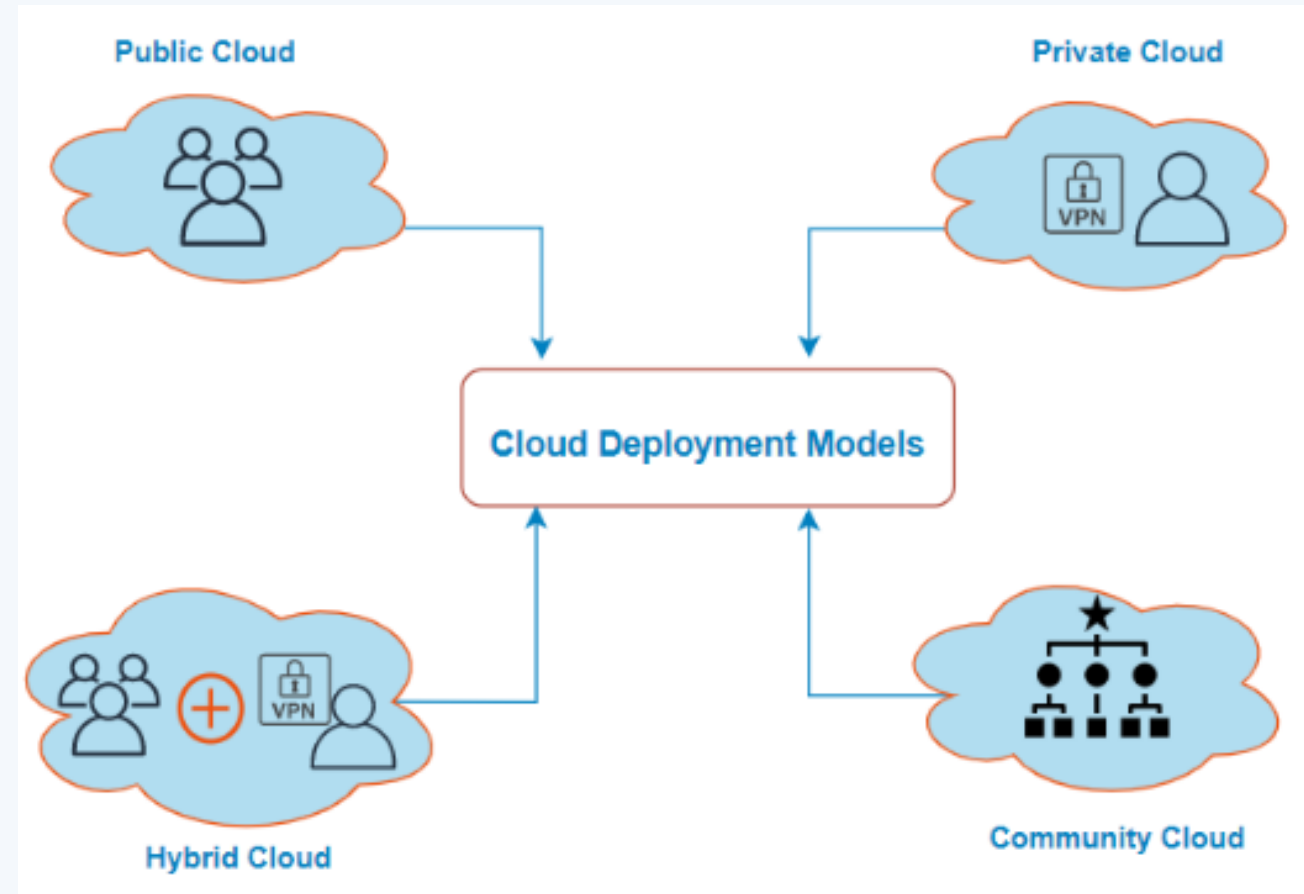
### 2.3. CHOOSING AMONG IAAS, PAAS AND SAAS

SaaS, PaaS, IaaS are not mutually exclusive; most organizations use more than one, and many larger organizations today use all three, often in combination with traditional IT.

Each cloud model offers specific features and functionalities, and it is crucial for organization to understand the differences. Whether they need cloud-based software for storage options, a smooth platform that allows them to create customized applications, or complete control over their entire infrastructure without having to physically maintain it, there is a cloud service for everyone [8].

### 3. DEPLOYMENT MODELS

The cloud deployment model identifies the specific type of cloud environment based on ownership, scale, and access, as well as the cloud's nature and purpose. The location of the servers you're utilizing and who controls them are defined by a cloud deployment model. It specifies how your cloud infrastructure will look, what you can change, and whether you will be given services or will have to create everything yourself. Relationships between the infrastructure and your users are also defined by cloud deployment types.



Cloud Deployment Models. Source <https://cloudiofy.com/types-of-cloud-computing/>

## 3. DEPLOYMENT MODELS



### 3.1. PUBLIC CLOUD

The public cloud makes it possible for anybody to access systems and services. The public cloud may be less secure as it is open for everyone. The public cloud is one in which cloud infrastructure services are provided over the internet to the general people or major industry groups. The infrastructure in this cloud model is owned by the entity that delivers the cloud services, not by the consumer. It is a type of cloud hosting that allows customers and users to easily access systems and services. This form of cloud computing is an excellent example of cloud hosting, in which service providers supply services to a variety of customers. In this arrangement, storage backup and retrieval services are given for free, as a subscription, or on a per-use basis. Example: Google App Engine etc.



## 3. DEPLOYMENT MODELS

### 3.1. PUBLIC CLOUD

Advantages of the public cloud model:

- **Minimal Investment:** Because it is a pay-per-use service, there is no substantial upfront fee, making it excellent for enterprises that require immediate access to resources.
- **No setup cost:** The entire infrastructure is fully subsidized by the cloud service providers, thus there is no need to set up any hardware.
- **Infrastructure Management is not required:** Using the public cloud does not necessitate infrastructure management.
- **No maintenance:** The maintenance work is done by the service provider (Not users).
- **Dynamic Scalability:** To fulfil your company's needs, on-demand resources are accessible.

## 3. DEPLOYMENT MODELS



### 3.2. PRIVATE CLOUD

The private cloud deployment model is the exact opposite of the public cloud deployment model. It's a one-on-one environment for a single user (customer). There is no need to share your hardware with anyone else. The distinction between private and public cloud is in how you handle all of the hardware. It is also called the "internal cloud" & it refers to the ability to access systems and services within a given border or organization. The cloud platform is implemented in a cloud-based secure environment that is protected by powerful firewalls and under the supervision of an organization's IT department.

The private cloud gives the greater flexibility of control over cloud resources.

### 3.2. PRIVATE CLOUD

Advantages of the private cloud model:

- **Better Control:** You are the sole owner of the property. You gain complete command over service integration, IT operations, policies, and user behaviour.
- **Data Security and Privacy:** It's suitable for storing corporate information to which only authorized staff have access. By segmenting resources within the same infrastructure, improved access and security can be achieved.
- **Supports Legacy Systems:** This approach is designed to work with legacy systems that are unable to access the public cloud.
- **Customization:** Unlike a public cloud deployment, a private cloud allows a company to tailor its solution to meet its specific needs.

### 3.3. COMMUNITY CLOUD

It allows systems and services to be accessible by a group of organizations. It is a distributed system that is created by integrating the services of different clouds to address the specific needs of a community, industry, or business. The infrastructure of the community could be shared between the organization which has shared concerns or tasks. It is generally managed by a third party or by the combination of one or more organizations in the community.

Advantages of the community cloud model:

- **Cost Effective:** It is cost-effective because the cloud is shared by multiple organizations or communities.
- **Security:** Community cloud provides better security.
- **Shared resources:** It allows you to share resources, infrastructure, etc. with multiple organizations.
- **Collaboration and data sharing:** It is suitable for both collaboration and data sharing.

### 3.4. HYBRID CLOUD

By bridging the public and private worlds with a layer of proprietary software, hybrid cloud computing gives the best of both worlds. With a hybrid solution, you may host the app in a safe environment while taking advantage of the public cloud's cost savings. Organizations can move data and applications between different clouds using a combination of two or more cloud deployment methods, depending on their needs.

Advantages of the hybrid cloud model:

- **Flexibility and control:** Businesses with more flexibility can design personalized solutions that meet their particular needs.
- **Cost:** Because public clouds provide for scalability, you'll only be responsible for paying for the extra capacity if you require it.
- **Security:** Because data is properly separated, the chances of data theft by attackers are considerably reduced [10].



## 3. DEPLOYMENT MODELS

### 3.5. COMPARISON TABLE OF TOP CLOUD DEPLOYMENT MODELS

Here is a comparative table that provides an overview of all four cloud deployment models:

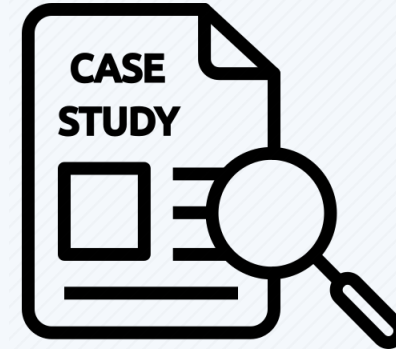
|                                     | PUBLIC         | PRIVATE                                  | COMMUNITY                              | HYBRID                                                         |
|-------------------------------------|----------------|------------------------------------------|----------------------------------------|----------------------------------------------------------------|
| <b>Ease of setup and use</b>        | Easy           | Requires IT proficiency                  | Requires IT proficiency                | Requires IT proficiency                                        |
| <b>Data security and privacy</b>    | Low            | High                                     | Comparatively high                     | High                                                           |
| <b>Data control</b>                 | Little to none | High                                     | Comparatively high                     | Comparatively high                                             |
| <b>Reliability</b>                  | Low            | High                                     | Comparatively high                     | High                                                           |
| <b>Scalability and flexibility</b>  | High           | High                                     | Fixed capacity                         | High                                                           |
| <b>Cost-effectiveness</b>           | The cheapest   | Cost-intensive; the most expensive model | Cost is shared among community members | Cheaper than a private model but more costly than a public one |
| <b>Demand for in-house hardware</b> | No             | Depends                                  | Depends                                | Depends                                                        |

Source: <https://study-ccna.com/cloud-deployment-models/>

## 4. PRACTICAL REAL CASE

### CLOUD CASE STUDIES - DELOITTE

A state agency improves performance by moving to cloud.



Moving to cloud is a growing imperative for government agencies—especially those at the state level. With any shift to the cloud comes the potential for benefits such as greater speed of business, reduced operating costs, IT simplicity, and enhanced security, which are all key for public sector organizations today.

For one state agency charged with fiscal responsibilities, cloud emerged as a central focus when its leaders sought to tame the complexity associated with human resources (HR) and payroll data while maintaining accountability and integrity. Done right, the move would give stakeholders greater access to data and bolster reliability, optimize costs, and provide scalability to support growth at the same time.

## 4. PRACTICAL REAL CASE

### CLOUD CASE STUDIES - DELOITTE

In particular, the agency encountered growing pains with its existing platform, which was oversized, high-cost, and ageing. As a result, the team couldn't move the data as is, or freely, on any other platforms. The choice they faced: Overcome budget constraints and invest in a major capital improvement project for current infrastructure or make a more strategic and cost-effective move to the cloud.

The challenge? Understanding the options and defining a path for an effective move. Scalability and costs were important considerations, but the complexities around cloud architecture presented challenges for the organization. Skill sets were also a key focus in planning a move to cloud—given the agency's reliance on specialized skills for maintaining its existing databases [11].

*"For one state agency charged with fiscal responsibilities, cloud emerged as a central focus when its leaders sought to tame the complexity associated with human resources and payroll data while maintaining accountability and integrity."*

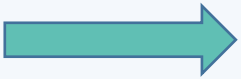
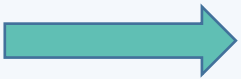
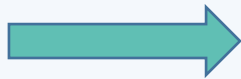
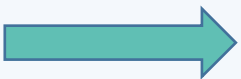
Source:

<https://www2.deloitte.com/us/en/pages/consulting/articles/government-cloud-adoption-benefits.html>

# ADDITIONAL READINGS

## INTERESTING AND COMPLEMENTARY ARTICLES/PAPERS/VIDEOS ABOUT BIG DATA

- Cloud Computing Service Models | IaaS PaaS SaaS Explained | Cloud Masters Program | Edureka  
<https://www.youtube.com/watch?v=n7B4icXvs74>
- Cloud Computing Full Course | Cloud Computing Tutorial For Beginners | Cloud Computing | Simplilearn  
[https://www.youtube.com/watch?v=EN4fEbcFZ\\_E](https://www.youtube.com/watch?v=EN4fEbcFZ_E)
- R Programming Tutorial - Learn the Basics of Statistical Computing  
[https://www.youtube.com/watch?v=\\_V8eKsto3Ug](https://www.youtube.com/watch?v=_V8eKsto3Ug)
- A2 – Introduction to Cloud Computing: <https://youtu.be/JkCAHih1JMw>



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- [3] IDM, “Types of Cloud Services”, [Online]. Available in: <https://medium.com/@IDMdatasecurity/types-of-cloud-services-b54e5b574f6> [Accessed on 22/08/2022]
- [4] Red Hat, “What is IaaS?”, [Online]. Available in: <https://www.redhat.com/en/topics/cloud-computing/what-is-iaas> [Accessed on 22/08/2022]
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- [6] Red Hat, “What is SaaS?”, [Online]. Available in: <https://www.redhat.com/en/topics/cloud-computing/what-is-saas> [Accessed on 22/08/2022]
- [7] Red Hat, “What is FaaS?”, [Online]. Available in: <https://www.redhat.com/en/topics/cloud-native-apps/what-is-faas> [Accessed on 22/08/2022]
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- [9] IBM Cloud Education, “IaaS versus PaaS versus SaaS”, [Online]. Available in: <https://www.ibm.com/cloud/learn/iaas-paas-saas#toc-what-are-i-Qr9fh442> [Accessed on 22/08/2022]
- [10] Geeksforgeeks, “Cloud Deployment Models?”, [Online]. Available in: <https://www.geeksforgeeks.org/cloud-deployment-models/> [Accessed on 22/08/2022]
- [11] Deloitte, « Cloud case studies A state agency improves performance by moving to cloud», [Online]. Available in: <https://www2.deloitte.com/us/en/pages/consulting/articles/government-cloud-adoption-benefits.html> [Accessed on 22/08/2022]

# Fostering diGitalisation and blonic transformation of SMEs through the development of a novel and innovative Training material for overcoming COVID-19 crisis

[HTTPS://GIST-PROJECT.EU/](https://gist-project.eu/)



**Thank  
you**



# TU.1

# LU. 6

**TRAINING UNIT 1 – I4.0 TECHNOLOGIES**

**LEARNING UNIT 6 – AUGMENTED AND VIRTUAL REALITY**



## LICENSES

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## FUNDING

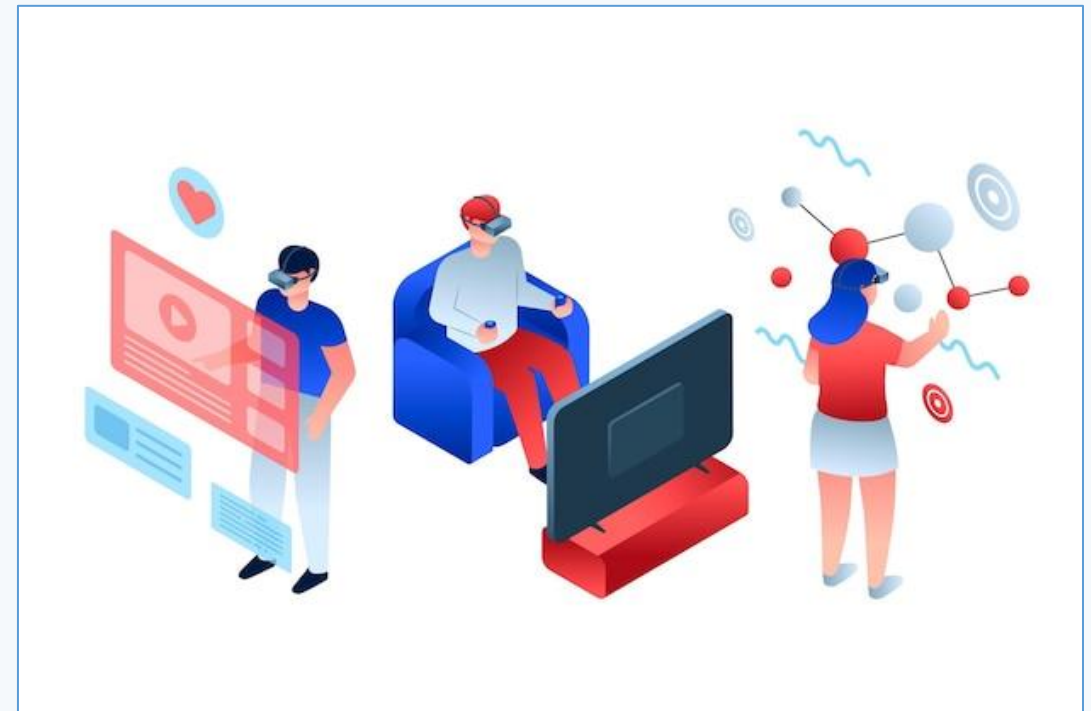
This training material has been developed within the framework of the “Fostering digitalisation and bionic transformation of SMEs through the development of a novel and innovative training material for overcoming COVID-19 crisis” (GIST) project.  
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## DISCLAIMER

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1. Introduction to Augmented Reality (AR) and Virtual Reality (VR)
  - 1.1. Augmented Reality (AR): Devices and current development
  - 1.2. Virtual Reality (VR): Devices and current development
  - 1.3. Mixed Reality (MR)
2. Available software and hardware
  - 2.1. Augmented Reality Software
  - 2.2. Virtual Reality Software
  - 2.3. Hardware



# 1. INTRODUCTION TO AUGMENTED REALITY (AR) AND VIRTUAL REALITY (VR)



Virtual, augmented, and recently, mixed reality (VR, AR and MR) are immersive media experiences that take digitalisation in business and society to the next level. These media enable new forms of use, simplify communication and production processes and then, the way people is learning, communicating and even working. This creates new challenges for both companies and society, because a lot of applications are being developed for the immersive media of augmented and virtual reality in areas such as education, marketing and health.

Augmented, virtual and mixed reality should not be seen as competing technologies, as the three of them have their individual potential and their advantages and disadvantages. In fact, one of the biggest differences between Augmented Reality (AR) or Mixed Reality (MR) and Virtual Reality (VR) is that AR or MR are more like a sort of individual experience, while with VR you can easily communicate and collaborate with other avatars, like in multiplayer videogames.

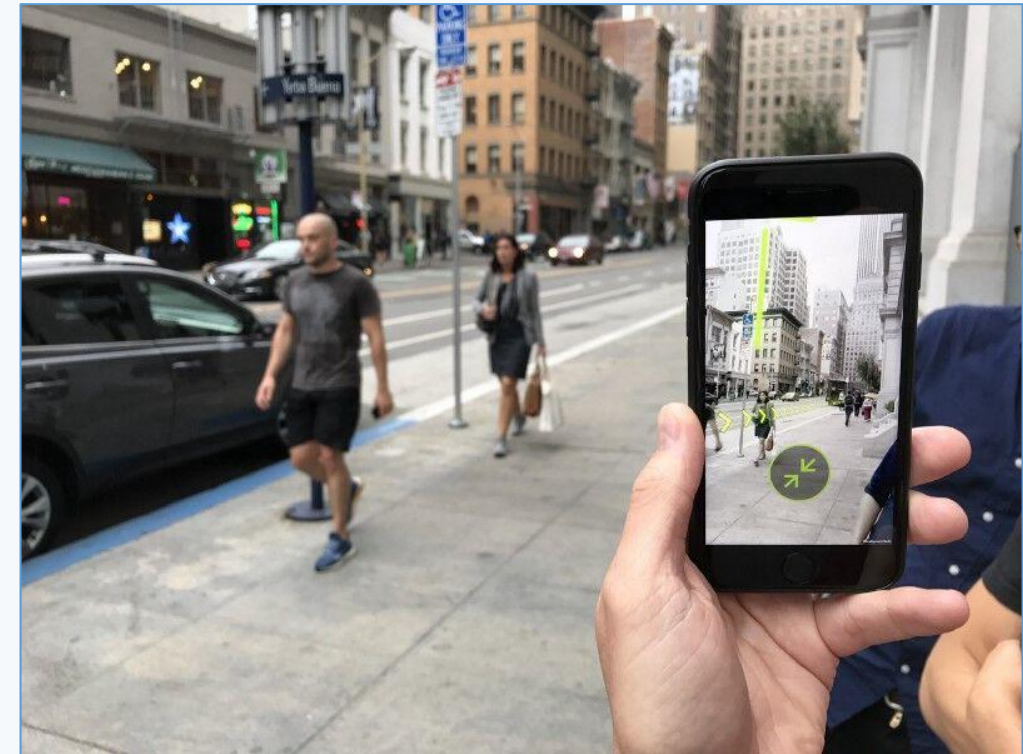
# 1. INTRODUCTION TO AUGMENTED REALITY (AR) AND VIRTUAL REALITY (VR)

## 1.1. AUGMENTED REALITY (AR): DEVICES AND CURRENT DEVELOPMENT

Augmented Reality can be defined as a technology that comprehends a set of tools offering a user experience in which real world is enriched with more and additional information.

This information is usually generated by a computer. Therefore, AR can be understood as an integration of the virtual world into the real world.

The real world can be augmented by one sense but also by several senses, making it possible to find visual, tactile, sound and even olfactory AR experiences, as well as different combinations of them. Focusing in augmented reality with visual components (the most typical one), these can be classified into non-immersive systems and immersive systems.



*Augmented reality example. Source: <https://ardev.es/realidad-aumentada/>*

# 1. INTRODUCTION TO AUGMENTED REALITY (AR) AND VIRTUAL REALITY (VR)



## 1.1. AUGMENTED REALITY (AR): DEVICES AND CURRENT DEVELOPMENT

In non-immersive systems user's orientation is monitored using sensors, and the real world is captured through a camera, which is shown to the user via a screen. Many developments in this technology use devices currently available on the market, such as smartphones and tablets, for capturing, processing and projecting the augmented experience. This technology is widespread, since the user doesn't have to expend money, as he already has the hardware that support the experience.

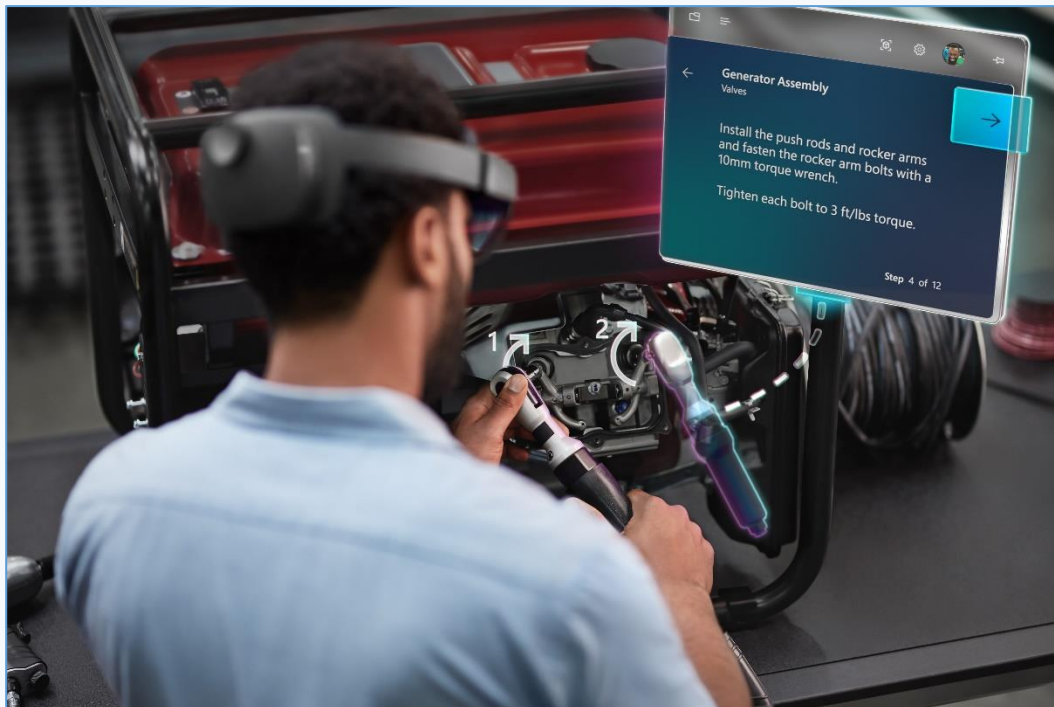
As for immersive systems, these are the same systems as for virtual reality experiences, but with a set of cameras to capture the real environment, displayed in the vision system. The experience is then a combination of the stereoscopic vision system and sensors and controls for interaction with the virtual elements.



# 1. INTRODUCTION TO AUGMENTED REALITY (AR) AND VIRTUAL REALITY (VR)

## 1.1. AUGMENTED REALITY (AR): DEVICES AND CURRENT DEVELOPMENT

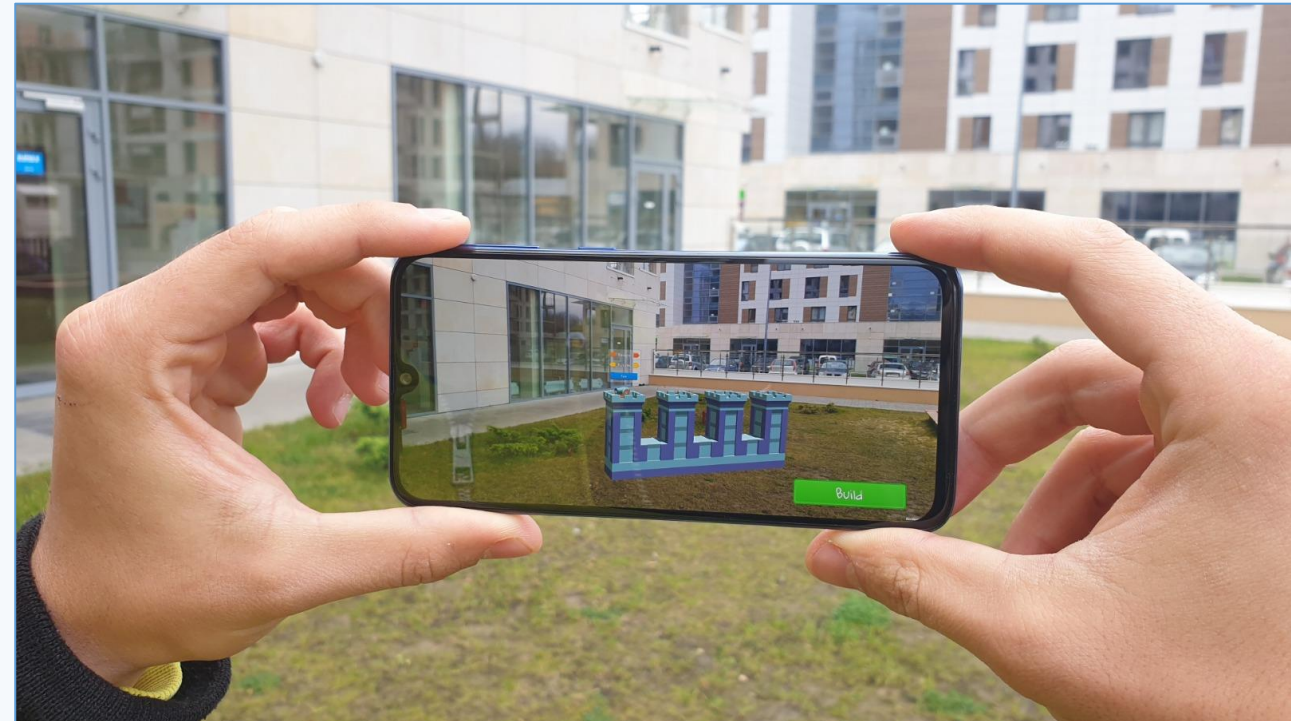
Augmented reality is generally spoken of when information and non-real elements are superimposed on the real world. Example of it can be devices such as Google Glass or HoloLens, by Microsoft. But probably the best and most-known example of augmented reality is Pokémon Go smartphone game, in which pokémons are superimposed on the real world, and are viewed by the user thanks to the screen of the smartphone.



On the left: HoloLens 2. Source: <https://sb.digital/blog/google-glass-vision-de-negocio-parte-2/>. On the right: Goggle glass. Source: <https://www.globbit.com/microsoft-hololens-2-realidad-aumentada-empresas-13754/>

# 1. INTRODUCTION TO AUGMENTED REALITY (AR) AND VIRTUAL REALITY (VR)

## 1.1. AUGMENTED REALITY (AR): DEVICES AND CURRENT DEVELOPMENT



Examples of Augmented Reality (AR): Source: <https://www.realityunit.one/what-the-ar-is/>. Source: <https://next.reality.news/news/8-wildest-augmented-reality-glasses-you-havent-seen-yet-0185268/>



# 1. INTRODUCTION TO AUGMENTED REALITY (AR) AND VIRTUAL REALITY (VR)

## 1.2. VIRTUAL REALITY (VR): DEVICES AND CURRENT DEVELOPMENT

Virtual reality has different approaches today. One term may refer to a technology-centred perspective and is understood as computer systems that create immersive and interactive environments through appropriate hardware such as stereo displays.

VR can also be described as a methodology for users to have an experience of inclusion in a virtual world or reality.

VR may serve to different purposes: researching, education, entertainment, supporting communication, visualising results or goals, etc. The main purpose of VR is to have an innovative interface between humans and computers.



*Virtual reality example. Source; Freepik*

# 1. INTRODUCTION TO AUGMENTED REALITY (AR) AND VIRTUAL REALITY (VR)

## 1.2. VIRTUAL REALITY (VR): DEVICES AND CURRENT DEVELOPMENT

Virtual reality systems or experiences may have different levels of immersion: non-immersive systems, semi-immersive systems and immersive systems. Immersive is understood as the capacity of a system to generate an environment that emulates an experience of presence in the real world.

Non-immersive VR systems show the virtual world by a combination of 3-dimensional images on an screen, sounds and a high degree of interaction with the simulated virtual world. The hardware for this is low-cost and easy to use and install. A nice example of this are desktop personal computer and video games. They are not immersive systems, but they can generate a high degree of user's attention and attraction.

As for semi-immersive VR systems or experiences, they use a projection system that displays the virtual environment on floor and walls of a room. They usually have a system for tracking user's head movements, for adjusting the simulation. They also incorporate a handheld device to interact with the virtual world. These systems need for a large space or rooms for installation and usually have a high cost.

Finally, immersive systems offer the highest degree of immersion. Here user's perception of the virtual world is as close as possible to the real world, blurring the lines between physical real world and digital or simulated one.

# 1. INTRODUCTION TO AUGMENTED REALITY (AR) AND VIRTUAL REALITY (VR)

## 1.2. VIRTUAL REALITY (VR): DEVICES AND CURRENT DEVELOPMENT

Immersive systems are generally comprised of a helmet with a stereoscopic vision system that allows the user to visually perceive the three-dimensional virtual world in a way that is identical to how the real world is perceived. The helmet normally incorporates sensors regarding the movement and position that allows the system to track user's position and movements and synchronize them with the virtual world in real time. It is also possible that the system have some headphones, or input devices like joysticks or gloves, for allowing more interaction with virtual world. The cost of these systems is medium-high.



*HTC Vive Pro. VR immersive system that incorporates glasses (helmet), headphones and remotes. Source: <https://interestingengineering.com/htcs-vive-pro-eye-kit-cracks-the-virtual-worlds-doors-open>*

# 1. INTRODUCTION TO AUGMENTED REALITY (AR) AND VIRTUAL REALITY (VR)

## 1.2. VIRTUAL REALITY (VR): DEVICES AND CURRENT DEVELOPMENT



VR tracking system and space available. Source:  
<https://www.aniwaa.com/guide/vr-ar/vr-headset-buying-guide/>

When we speak of VR, we mean that the viewer is completely immersed in another world. This immersive experience can completely isolate the viewer from the outside world by using VR goggles with headphones to make him virtually forget the real world and control his avatar with gestures, controllers or a special suit via motion tracking.

If elements of the real world are integrated into the virtual world, for example, objects that can be used in the virtual world, we speak of augmented reality.



# 1. INTRODUCTION TO AUGMENTED REALITY (AR) AND VIRTUAL REALITY (VR)

## 1.2. VIRTUAL REALITY (VR): DEVICES AND CURRENT DEVELOPMENT

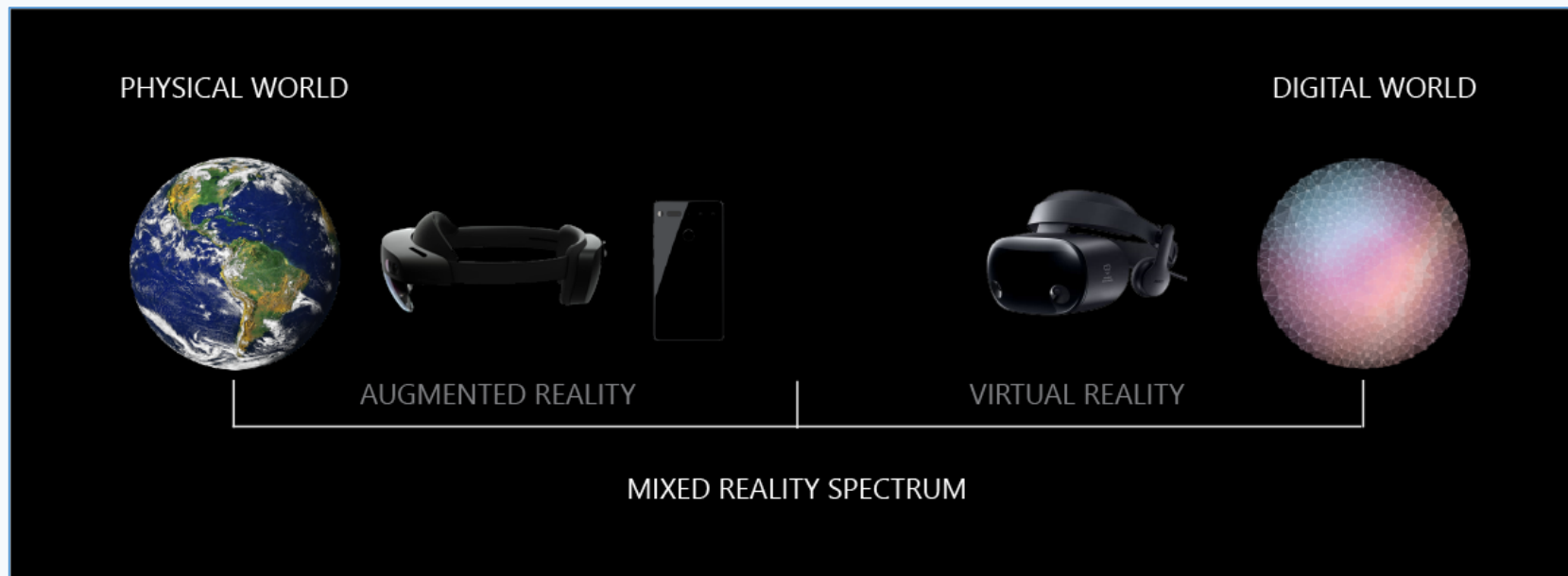


Virtual Reality (VR) examples. Source: [https://www.ibzstore.com/?category\\_id=14740324](https://www.ibzstore.com/?category_id=14740324). Source: <https://virtualrealitypop.com/haptx-scores-new-capital-and-strategic-partner-to-commercialize-haptic-data-gloves-5d198fc98a6f>

# 1. INTRODUCTION TO AUGMENTED REALITY (AR) AND VIRTUAL REALITY (VR)

## 1.3. MIXED REALITY (MR)

As regards of Mixed Reality (MR), this kind of system belongs to the continuous spectrum of virtuality, integrating the virtual world with the real world, but in this case, MR technology goes one step further, and allows the interaction of the physical elements of the environment with the virtual elements.



Mixed Reality. Source: <https://docs.microsoft.com/es-es/windows/mixed-reality/discover/mixed-reality>



Examples of Mixed Reality. Source: <https://docs.microsoft.com/es-es/windows/mixed-reality/discover/types-of-mixed-reality-apps>



## 2. AVAILABLE SOFTWARE AND HARDWARE

Designing for VR, AR and MR is like creating new realities. This new paradigm of immersive and multidimensional content creation demands new rules and considerations. Designing for AR/VR/MR leverages existing skills ranging from 3D visual design to experience design and development, among others.

The following table lists the most relevant programming and development tools on the market for these technologies:

| SOFTWARE               | TARGET PLATFORMS                                                                            | ENABLED TECHNOLOGIES |    |    |
|------------------------|---------------------------------------------------------------------------------------------|----------------------|----|----|
|                        |                                                                                             | VR                   | AR | MR |
| <a href="#">Unity</a>  | Web<br>PC<br>Mobil Devices<br>Smart TV<br>Game consoles<br>Virtual/Extended Reality Devices | X                    | X  | X  |
| <a href="#">Unreal</a> | Web<br>Smart TV<br>Game consoles<br>Virtual/Extended Reality Devices                        | X                    | X  | X  |
| <a href="#">WebVR</a>  | Web                                                                                         | X                    | X  |    |
| <a href="#">Native</a> | Depends on the platform                                                                     | X                    | X  | X  |

## 2. AVAILABLE SOFTWARE AND HARDWARE



### 2.1. AUGMENTED REALITY SOFTWARE

AR software helps create computer-enhanced immersive experiences for virtual tours, gaming environments, and training simulations. AR tools can also be used in retail to help customers virtually try the product before the purchase is made.

AR is a relatively new and growing technology, with many new types continuing to emerge. Main types of AR software found on market are listed now:

- AR visualization software
- AR content management systems (CMS)
- AR SDK
- AR WYSIWYG editor software
- VR game engine
- AR training simulator software
- Industrial AR platforms



## 2. AVAILABLE SOFTWARE AND HARDWARE

### 2.1. AUGMENTED REALITY SOFTWARE

AR visualization software enables organizations to create immersive experiences for consumers to interact with. AR visualization software users can upload 3D content and scale the image, adjust the color, and incorporate the additional details needed to give the best user experience possible.

AR Content Management System (CMS) lets users bulk upload raw 3D content that will eventually become the basis for AR experiences.

AR SDK allow users to build digital objects that will blend into the real world that will eventually become fully fledged AR experiences.

AR WYSIWYG editor software enables users with limited to no coding background to create customized AR experiences. These tools have drag-and-drop capabilities that let users upload 3D objects and drop them directly into previously designed scenes.

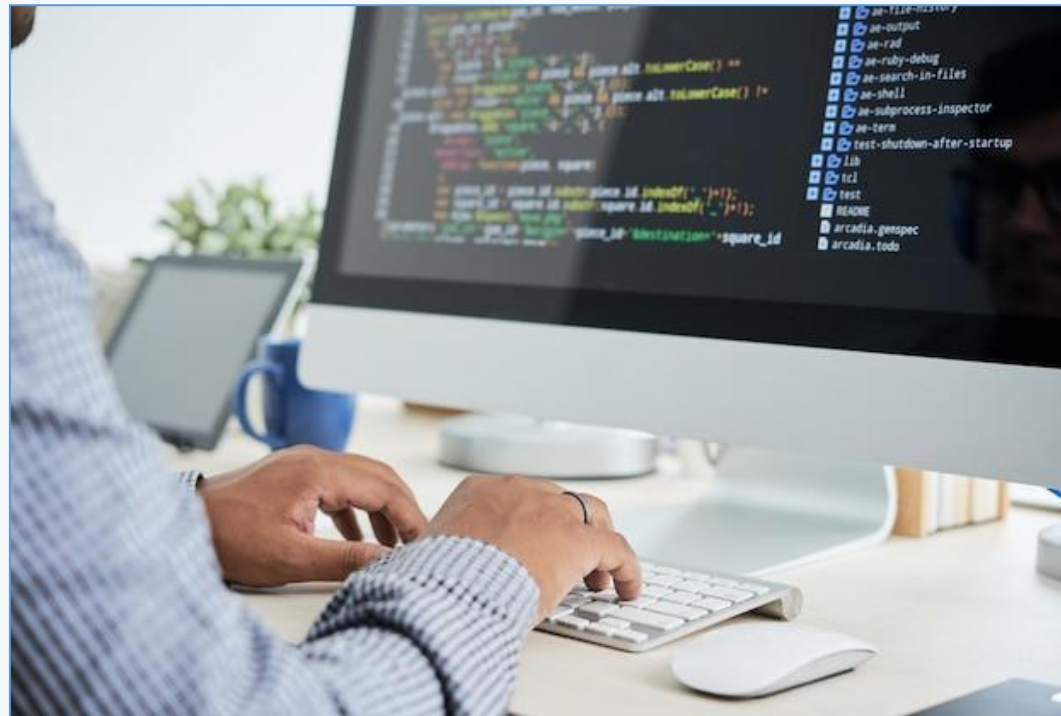
AR game engine software give game developers the framework for creating AR video game experiences. Using AR game engine software, users can create and edit 3D characters that can interact with the real world.

## 2. AVAILABLE SOFTWARE AND HARDWARE

### 2.1. AUGMENTED REALITY SOFTWARE

AR training simulator software leverages AR technology to train employees for certain jobs.

Industrial AR platforms are typically used by organizations in the industrial field. These tools include interactive AR content that improves these employees' productivity, effectiveness, and safety.



AR Software.  
Source: Freepik

## 2. AVAILABLE SOFTWARE AND HARDWARE

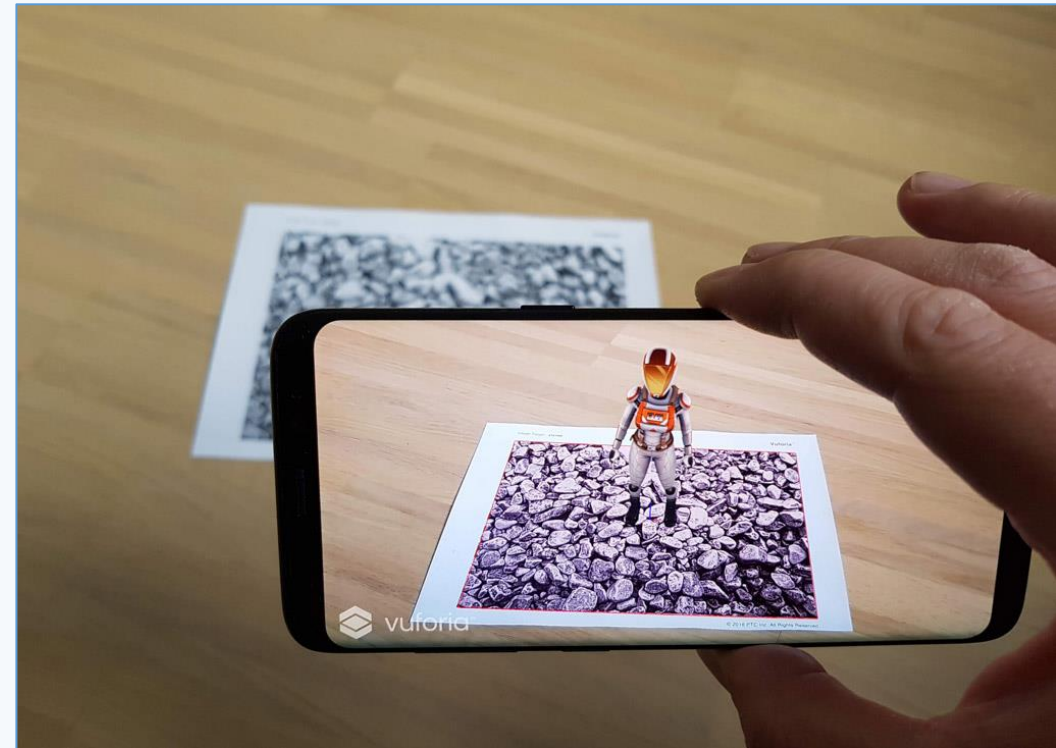
### 2.1. AUGMENTED REALITY SOFTWARE

To develop an AR application, there is a need to use AR platforms which enable the developers to implement AR applications with predefined features of AR. In the following table, the 9 most representative AR SDKs for both Android and the IO operating system are listed:

- [ARkit](#)
- [ARCore](#)
- [Vuforia](#)
- [Wikitude](#)
- [Maxst](#)
- [DeepAR](#)
- [EasyAR](#)
- [ARToolkit](#)
- [Xzimg](#)
- [Dynamics 365 Guides](#)

There are also some AR 3D Viewers:

- [Augmented](#)
- [Aurasma](#)
- [BlippAR](#)



Vuforia sample. Source: <https://library.vuforia.com/articles/Solution/Native-Image-Target-Sample.html>

## 2. AVAILABLE SOFTWARE AND HARDWARE

### 2.1. AUGMENTED REALITY SOFTWARE

- [ARKit](#): an AR framework that allows developers to create augmented reality applications and games for iPhones and iPads. This SDK supports either iOS 11 or 12 version. ARKit provides 2D image detection (trigger AR with posters, signs, images) and 2D image tracking, the possibility to embed objects into AR. This SDK also empowers to recognize spaces and 3D objects and place virtual objects on surfaces. In the new updated version of ARKit there is a possibility to implement games which can be played between two iPads by playing two different people.
- [ARCore](#): a developing platform for AR which is developed by Google. This platform also supports for both Android and iOS devices, but the minimum version of the Android devices should be 7.0 and for the iOS it should be 11. Mainly ARCore is created based on real-time position tracking and integration of virtual and real objects. It allows to place objects, texts, or any information within the physical surroundings.
- [Vuforia](#): AR framework which helps developers to create AR experiences. It has the functionalities such as recognition of different types of visual objects (box, cylinder, plane), text and environments recognition, VuMark which is the combination of picture and QR code. There is also a functionality used in Vuforia called 'Vuforia Object Scanner' which allows to scan and create object targets. The recognition process can be implemented by using the database (local or cloud storage). Unity plugin can be also integrated and used by Vuforia.

Your Text Here

## 2. AVAILABLE SOFTWARE AND HARDWARE

### 2.1. AUGMENTED REALITY SOFTWARE

- [Wikitude](#): an AR platform which supports different platforms including Android, iOS, Windows for tablets, smart glasses (Epson Moverio, Vuzix M100, ODG R-7). This SDK also supports different development frameworks, such as Native API, JavaScript API, Unity3D, Xamarin, Titanium and Cordova. Wikitude also enables to download SDK and a sample app, read the documentation, and start implementing an AR application with any different knowledge of development. Wikitude has also some AR features, such as image recognition, object recognition, 3D markerless tracking, ARKit and ARCore support.
- [Maxst](#): an AR SDK which supports different platforms including Android, iOS, Windows, Mac OS, and Unity. This framework consists of different features including instant tracker, visual SLAM, object tracker, image tracker, cloud recognition, marker tracker, QR code tracker, QR/Barcode reader and smart glasses calibration. The generation of image database is online via Target Manager, but developers can also request for a module that allows to train target image offline at a cost.
- [DeepAR](#): to detect faces and facial features in real time, based on patented data models and machine learning techniques. The rate of recognizing is fast and is about 70 facial points at 60 frames per second. Furthermore, DeepAR's engine performs precise image rendering which is improved for mobile and web apps. DeepAR supports different platforms including PC, Android, iOS, Windows, WebGL.



## 2. AVAILABLE SOFTWARE AND HARDWARE

### 2.1. AUGMENTED REALITY SOFTWARE

- [EasyAR](#): an AR SDK which supports different platforms such as Android, iOS, UWP, Windows, Mac, and Unity Editor. The EasyAR includes features such as 3D object recognition, environment perception, cloud recognition, smart glass solution and app cloud packaging. EasyAR is easy to integrate and it has a good documentation and the examples are understandable.
- [ARToolkit](#): Open-source library for AR. It includes the following functionalities: Single-camera or stereo-camera and camera position/orientation tracking. Tracking of simple black squares. Tracking of planar images. Camera calibration and optical stereo calibration. Plugins for Unity and OpenSceneGraph. Optical head-mounted display support. Free and opensource software. Fast enough for real time AR applications. ARToolKit supports different platforms including Android, iOS, Linux, Windows, Mac OS and Smart Glasses.
- [Xzing](#): AR SDK which is developed for real-time face tracking and to create AR based apps. These implemented apps are appropriate for desktop apps, mobile apps, and web browsers via a Unity plugin. This AR SDK supports different platforms such as Android, iOS, and Windows. Xzing includes Augmented Vision, Augmented Face and Magic Face products.
- [Dynamics 365 Guides](#): a MR application for Microsoft HoloLens that helps operators learn during the flow of work by providing holographic instructions when and where they're needed. These instruction cards are visually tethered to the place where the work is done, and can include images, videos, and 3D holographic models. With Dynamics 365 Guides, you don't need specialized 3D or programming skills.

## 2. AVAILABLE SOFTWARE AND HARDWARE

### 2.1. AUGMENTED REALITY SOFTWARE

And as for the AR 3D viewers:

- [Augment](#): The platform for 3D and AR product visualization, consists in an AR 3D viewer, composed by an application for mobile devices and a web-based platform, in which its users can register their own markers and associate them with 3D models and other virtual elements. Augment offers planar marker tracking and tracking via cloud storage.
- [Aurasma](#): Classified as an AR 3D viewer, Aurasma provides their own mobile application and a web-based platform, through which they allow their users to transform objects, images and places in new interactive opportunities using graphic content, animations, videos, audios and 3D content. It allows tracking of planar and geolocated targets, as well as tracking via cloud storage.
- [BlippAR](#): an AR 3D viewer that provides their own smartphone application and a web-based platform so that their users can register their markers and link them with many visual and interactive assets. BlippAR allows the user to track planar targets via cloud. It also instantiates a computer vision module with Artificial Intelligence (AI) and Deep Learning (DL) algorithms, increasing the application's capacities by making possible that it eventually learns to recognize different things that the user may direct it to-wards.

## 2. AVAILABLE SOFTWARE AND HARDWARE

### 2.1. AUGMENTED REALITY SOFTWARE

An AR Content Management System (CMS) is used to bulk upload raw 3D content that will serve as the basis for AR experiences. Users can manage their AR content within this platform, as well as edit it using the product's drag-and-drop capabilities. These editing functionalities enable users to make changes to their content, such as adding color and various textures to their 3D products.

An AR CMS may also have the capability to function as an AR SDK for a more customizable AR experience.

This content is typically used to create various AR apps for mobile devices. These solutions also offer reporting and analytics, so that companies can better understand the behaviour of the audience using their content. An AR CMS should not be confused with a VR CMS, which is a platform that allows users to upload, manage, and publish virtual reality content.

- [ZapWorks](#)
- EnvolverAR
- [Itsilesia](#)



ZapWorks. Source:  
<https://emiliusvgs.com/zappar-works-realidad-aumentada-usuario/>

## 2. AVAILABLE SOFTWARE AND HARDWARE

### 2.1. AUGMENTED REALITY SOFTWARE

- [ZapWorks](#): ZapWorks is the most robust AR toolkit for companies who want to push the boundaries of creativity and storytelling. Using the ZapWorks ecosystem, you can rapidly build, publish, analyze and scale immersive AR experiences across the complete customer journey.
- [EvolveAR](#): EvolveAR provides a full set of AR features that will help you create, play, and deliver a totally immersive user. It contains all the major Augmented Reality features like videos, audios, action buttons (CTA), images, 360° videos, and 3D models.
- [Itsilesia](#): With fully scalable solutions Itsilesia can prepare a source of information or an educational tool operating on plenty of different platforms – starting from web pages and web applications, through mobile applications, interactive touch tables, desktop applications, up to advanced 3D virtual reality simulators.

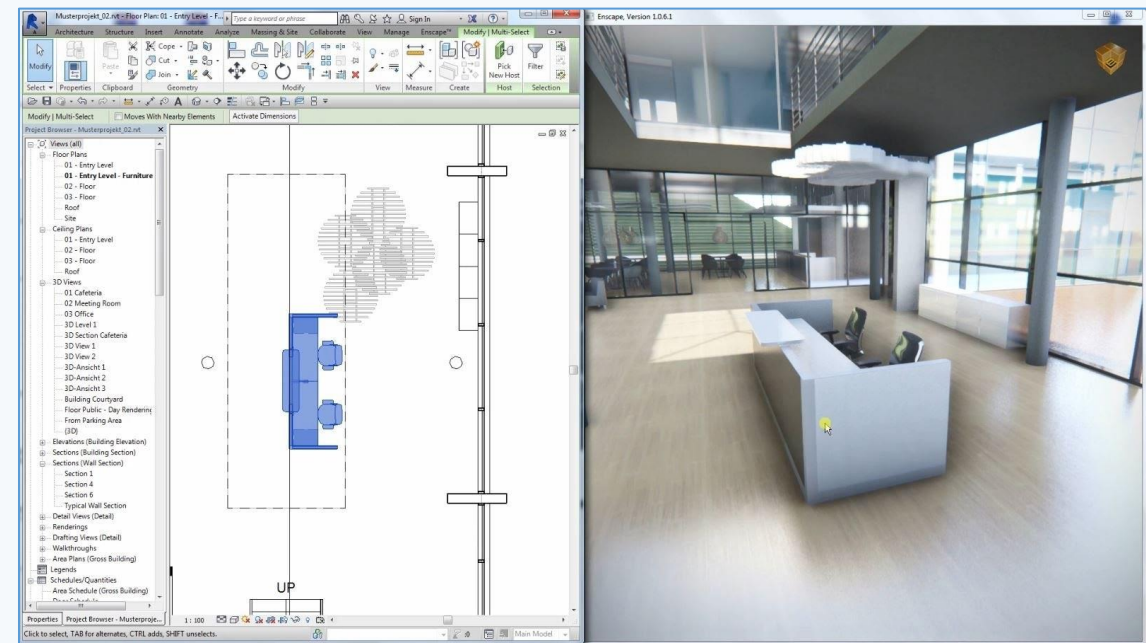
## 2. AVAILABLE SOFTWARE AND HARDWARE

### 2.2. VIRTUAL REALITY SOFTWARE

Several steps are needed to create an ideal VR user experience. The virtual world is created by software developers and then rendered so that users can interact with the objects created by the developers. The headsets help to provide users with the illusion of being fully immersed in the 3D environment. These 3D objects tend to respond to changes in the user's movement, and the interactions simulate those of the real world. Additional hardware components, such as gloves or other accessories in the room, can also simulate other senses, such as touch.

VR is a technology that is constantly changing, so different subcategories of the technology are still emerging. The following are some of the types of software needed to work with VR:

- VR visualization
- VR content management systems
- VR SDK
- VR game engine
- VR social platforms
- VR training simulation



VR Software. Source: <https://architazer.com/blog/practice/tools/young-architect-guide-vr-software/>



## 2. AVAILABLE SOFTWARE AND HARDWARE



### 2.2. VIRTUAL REALITY SOFTWARE

VR visualization allows users to experience aggregated data in a virtual environment. These tools enable users to see analytics in a way for them to fully understand what the data are communicating.

VR content management systems provide the necessary base to design, build, and test VR experiences.

VR SDK act as the building blocks to create basically any VR experience.

VR game engine provides developers with the essential for creating a VR video game experience.

VR social platforms, in which users can collaborate in VR from remote locations.

VR training simulator can be used in almost any industry to train employees in a completely immersive environment.

## 2. AVAILABLE SOFTWARE AND HARDWARE

### 2.2. VIRTUAL REALITY SOFTWARE

VR software comes equipped with a multitude of features that allows users to create a complete VR experience. Some of the features available include content management, where users can upload their raw 3D content and then edit it to create a VR experience or use existing content and publish it from these platforms, content editing, where users can edit the raw 3D content or existing VR experiences, and hardware integration, where any VR solution must integrate with hardware that supports VR experiences. These devices are usually headsets but can also be mobile phones.

Virtual Reality software development kits, or VR SDKs, provide the fundamental tools to design, create, and test VR experiences. A list of software that can be considered SDK platforms is provided:

- [Contentful](#)
- [Kentico Kontent](#)
- [Contentstack](#)
- [EZ360](#)
- [Headjack](#)
- [IdeaSpaceVR](#)
- [Smart2VR](#)
- [TIBVR](#)
- [Viar360](#)
- [Virtours](#)
- [SimLab Soft](#)

## 2. AVAILABLE SOFTWARE AND HARDWARE

### 2.2. VIRTUAL REALITY SOFTWARE

- [Contentful](#): the next-generation content platform to build digital experiences at scale. It enables teams to unify content in a single hub, to structure it for use in any digital channel, and integrate seamlessly with hundreds of other tools through open APIs and powerful integration capabilities.
- [Kentico Kontent](#): a headless CMS that simplifies content production for marketers so that they can focus on creating high-quality content without requiring developers involvement. This frees developers to focus on what they best do, building engaging online experiences that look great in every channel.
- [Contentstack](#): renowned for earning the highest customer satisfaction in the industry, Contentstack combines the best of Content Management System (CMS) and digital experience (DXP) technology, enabling enterprises to manage content across all digital channels and create inimitable digital experiences.
- [EZ360](#): with EZ360 Cloud, 360-degree video content can be distributed to VR devices via the cloud. Upload and manage videos in the online Content Management System (CMS). Easily push videos to VR devices. VR headsets automatically download new videos when they start the app. No more sideloading or transferring files one headset at the time. With EZ360 Cloud it is possible to distribute 360 videos all around the world.

### 2.2. VIRTUAL REALITY SOFTWARE

- [Headjack](#): an app creation and content management platform for 360 video producers. Inspired by WordPress, Headjack allows non-technical users to easily create and manage standalone VR apps which run on all the currently available VR headsets, while also giving developers the ability to tweak the source code to their liking using Headjack's Unity API.
- [IdeaSpaceVR](#): free, open-source, self-hosted PHP content management platform for 3D and virtual reality web experiences for desktop PCs, mobile devices & VR headsets.
- [SmartVR](#): a CMS platform to publish and distribute your Virtual Reality content in your own branded VR app (iOS and Android), on your website and on the Samsung Gear VR.
- [TIBVR](#): the first company in the world to provide companies or individuals with their very own virtual reality website with built in real-time content management system. It allows to create virtual reality web experiences and manage VR space and assets simply through the WordPress customizer.

### 2.2. VIRTUAL REALITY SOFTWARE

- [Viar360](#): the most intuitive authoring and publishing platform that reduces the time, effort and knowledge required to create highly engaging immersive training and learning experiences from 360° videos and photos.
- [Virtours](#): Ikon's patented software solution for the creation, distribution and visualization of VR content using a single integrated platform. Virtours offers high quality virtual experiences designed for business and customers. A complete platform to create, distribute and enjoy VR content simply, quickly and easily.
- [SimLab Soft](#): a complete, easy, affordable and feature-rich solution that allows users to communicate ideas in 3D with ease. SimLab has all the tools needed to import models, create dynamic visualisations, render, build simple VR scenes, all to create fully interactive VR training sessions.

## 2. AVAILABLE SOFTWARE AND HARDWARE

### 2.3. HARDWARE

VR, AR and MR helmets have undergone significant improvements in recent years, becoming smaller, lighter, more comfortable, more powerful, and cheaper. Some of these devices only have the capacity to support one of the technologies (AR, VR, or MR) while other devices have the capacity to support all three.

| DEVICE              | DEVELOPMENT PLATFORMS                                                                              | TECHNOLOGIES |    |    | LEVEL OF IMMERSION |
|---------------------|----------------------------------------------------------------------------------------------------|--------------|----|----|--------------------|
|                     |                                                                                                    | VR           | AR | MR |                    |
| Smartphone / Tablet | <a href="#">Unity</a><br><a href="#">Unreal</a><br><a href="#">Native</a>                          | X            | X  |    | No-immersive       |
| Google Card Board   | <a href="#">Unity</a><br><a href="#">Unreal</a><br><a href="#">Native</a><br><a href="#">WebVR</a> | X            | X  |    | Immersive          |
| HTC Vive            | <a href="#">Unity</a><br><a href="#">Unreal</a><br><a href="#">Native</a><br><a href="#">WebVR</a> | X            | X  |    | Immersive          |
| Oculus Rift         | <a href="#">Unity</a><br><a href="#">Unreal</a><br><a href="#">Native</a><br><a href="#">WebVR</a> | X            | X  |    | Immersive          |



## 2. AVAILABLE SOFTWARE AND HARDWARE

### 2.3. HARDWARE

| DEVICE        | DEVELOPMENT PLATFORMS                                                                              | TECHNOLOGIES |    |    | LEVEL OF IMMERSION |
|---------------|----------------------------------------------------------------------------------------------------|--------------|----|----|--------------------|
|               |                                                                                                    | VR           | AR | MR |                    |
| HTC Vive Pro  | <a href="#">Unity</a><br><a href="#">Unreal</a><br><a href="#">Native</a><br><a href="#">WebVR</a> | X            | X  | X  | Immersive          |
| CAVE          | <a href="#">Native</a>                                                                             | X            |    |    | Semi-immersive     |
| Oculus Rift S | <a href="#">Unity</a><br><a href="#">Unreal</a><br><a href="#">Native</a>                          | X            | X  | X  | Immersive          |
| Hololens 2    | <a href="#">Unity</a><br><a href="#">Unreal</a><br><a href="#">Native</a><br><a href="#">WebVR</a> | X            | X  | X  | Immersive          |

### 3. CONCLUSIONS



Virtual reality (VR) is a simulated experience that can be similar or completely different from the real world. Applications of virtual reality include entertainment (particularly video games), education (such as medical or military training) and business (such as virtual meetings).

Modern virtual reality headset displays are based on technology developed for smartphones including gyroscopes and motion sensors for tracking head, body, and hand positions; small HD screens for stereoscopic displays; and small, lightweight and fast computer processors. These components led to relative affordability for independent VR developers, and lead to the 2012 Oculus Rift Kickstarter offering the first independently developed VR headset.

Augmented reality (AR) is an interactive experience of a real-world environment where the objects that reside in the real world are enhanced by computer-generated perceptual information, sometimes across multiple sensory modalities, including visual, auditory, haptic, somatosensory and olfactory. AR can be defined as a system that incorporates three basic features: a combination of real and virtual worlds, real-time interaction, and accurate 3D registration of virtual and real objects.

Hardware components for augmented reality are a processor, display, sensors and input devices. Modern mobile computing devices like smartphones and tablet computers contain these elements, which often include a camera and microelectromechanical systems (MEMS) sensors such as an accelerometer, GPS, and solid-state compass, making them suitable AR platforms.

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# Fostering diGitalisation and blonic transformation of SMEs through the development of a novel and innovative Training material for overcoming COVID-19 crisis

[HTTPS://GIST-PROJECT.EU/](https://gist-project.eu/)



**Thank  
you**

# TU.1

# LU.7

**TRAINING UNIT 1 – I4.0 TECHNOLOGIES**

**LEARNING UNIT 7 – BIG DATA**





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## 1. Introduction to Big Data, characteristics and dimensions of scalability

### 1.1 Big Data architecture and patterns

## 2. The process of data analysis

### 2.1 Acquiring data

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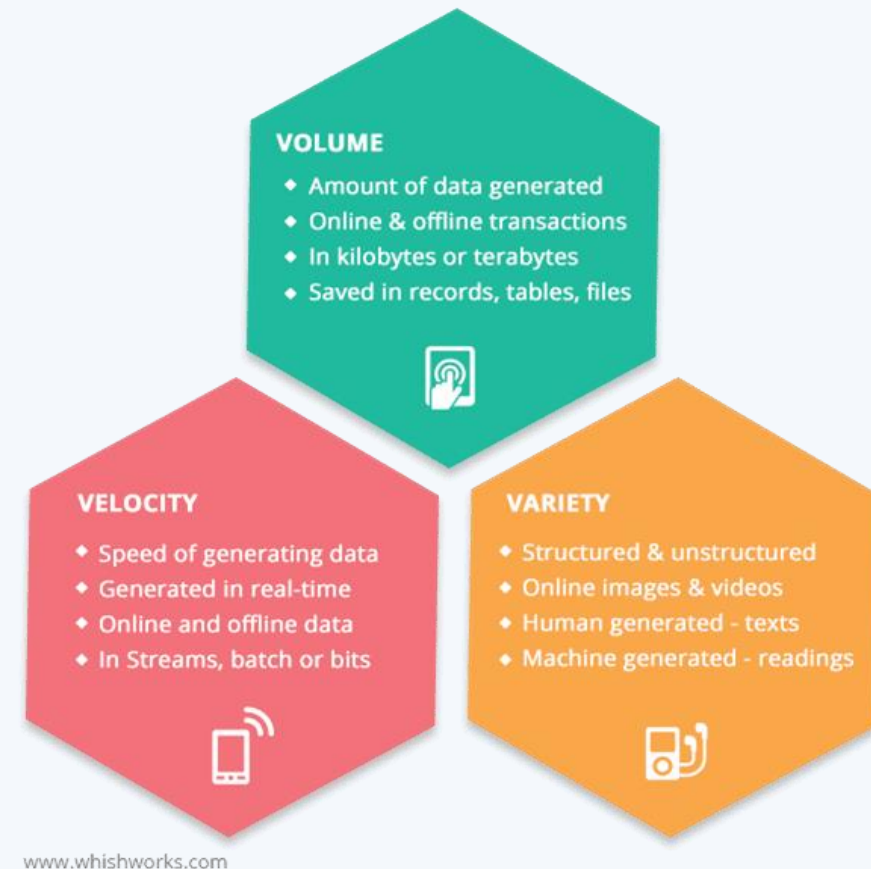
Big Data. Source: <https://www.zm-online.de/news/politik/den-kompetenten-umgang-mit-big-data-staerken/>

# 1. INTRODUCTION TO BIG DATA, CHARACTERISTICS AND DIMENSIONS OF SCALABILITY

## 1.1 BIG DATA ARCHITECTURE AND PATTERNS

The term “big data” seems to be popping up everywhere these days. Big data is a combination of structured, semi structured and unstructured data collected by organizations that can be mined for information and used in machine learning projects, predictive modeling and other advanced analytics applications.

The definition of big data is data that contains greater **variety**, arriving in increasing **volumes** and with more **velocity**. This is also known as the three Vs [1].

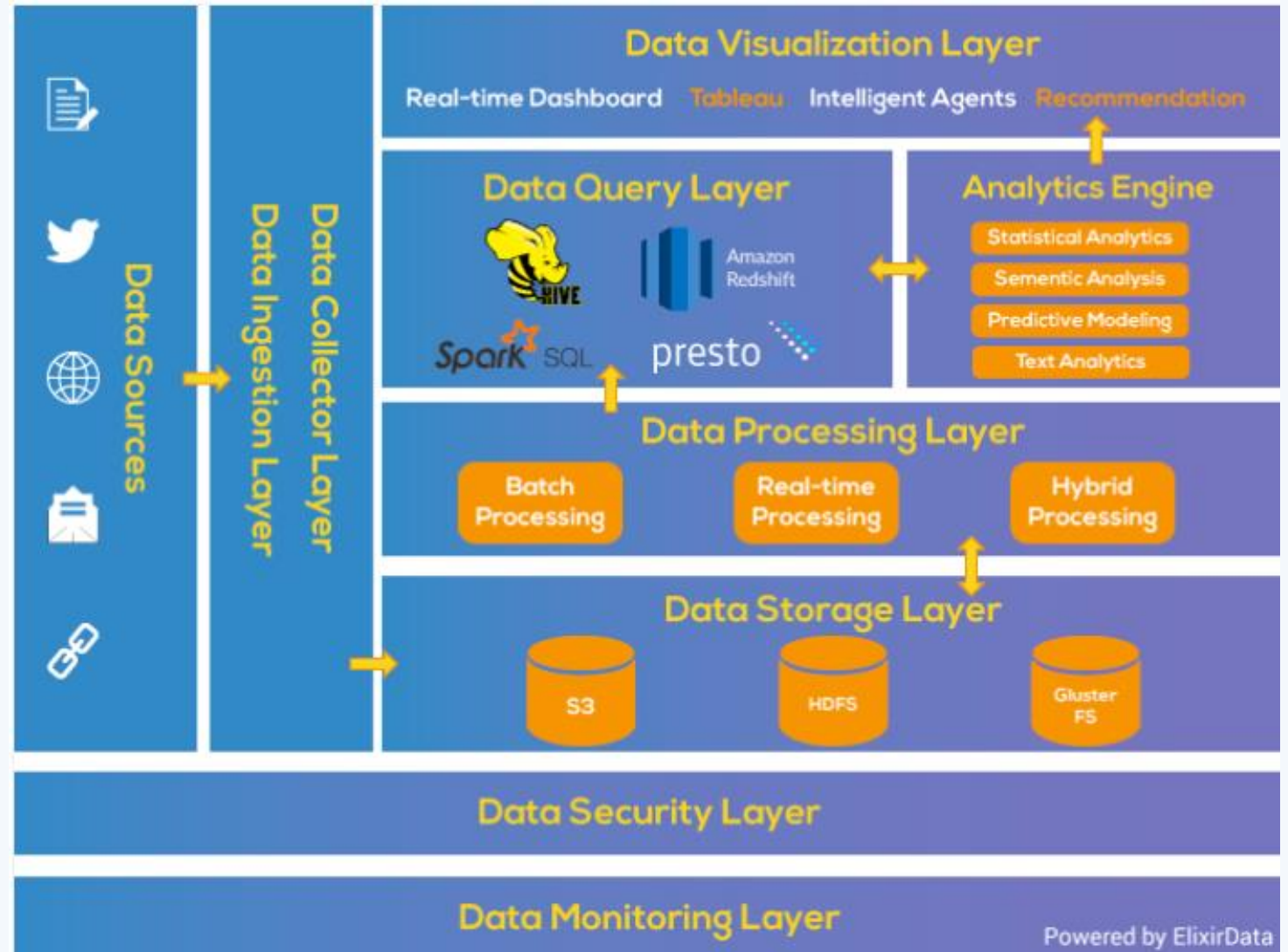


The Three V's of Big Data. Source: <https://www.coforge.com/salesforce/blog/data-analytics/understanding-the-3-vs-of-big-data-volume-velocity-and-variety/>

# 1. INTRODUCTION TO BIG DATA, CHARACTERISTICS AND DIMENSIONS OF SCALABILITY

## 1.1 BIG DATA ARCHITECTURE AND PATTERNS

The Best way to perform a solution is to “Split The Problem”. This is applied to Big Data Solution, that can be well understood using a layered architecture. The layered architecture is divided into different layers where each layer performs a particular function.



Big Data Architecture. Source:

<https://www.xenonstack.com/blog/big-data-architecture>

## 2. THE PROCESS OF DATA ANALYSIS

### 2.1 ACQUIRING DATA

Data Science is about extracting knowledge from data. It is a multidisciplinary craft that combines people, process, computational and Big Data platforms, application-specific purpose, and programmability. Publications and provenance of the data products leading to these publications are also important for data science, but it is important to start by defining 5 P's that take significant part in the data science activities: **Purpose, people, process, platforms, programmability**.

#### PURPOSE

Purpose comes when people use generalizable processes with a particular goal in mind. The purpose can be related to a scientific analysis with a hypothesis or a business metric that needs to be analyzed based often on Big Data. Note that similar reusable processes can be applicable to many applications with different purposes when employed within different workflows.

## 2. THE PROCESS OF DATA ANALYSIS

### 2.1 ACQUIRING DATA

#### PEOPLE

The data scientists are often seen as people who possess skills on a variety of topics including: science or business domain knowledge; analysis using statistics, machine learning and mathematical knowledge; data management, programming and computing. In practice, this is generally a group of researchers comprised of people with complementary skills.

#### PROCESS

The process of data science includes techniques for statistics, machine learning, programming, computing and data management. Data science workflows combine such steps in executable graphs. We believe that process-oriented thinking is a transformative way of conducting data science to connect people and techniques to applications. Challenges for the data science process include 1) how to easily integrate all needed tasks to build such a process; 2) how to find the best computing resources and efficiently schedule process executions to the resources based on process definition, parameter settings, and user preferences.



## 2. THE PROCESS OF DATA ANALYSIS

### 2.1 ACQUIRING DATA

#### PLATFORMS

Based on the needs of an application-driven purpose and the amount of data and computing required to perform this application, different computing and data platforms can be used as a part of the data science process. This scalability should be made part of any data science solution architecture.

#### PROGRAMMABILITY

Capturing a scalable data science process requires aid from programming languages, e.g., R, and patterns, e.g., MapReduce. Tools that provide access to such programming techniques are key to making the data science process programmable on a variety of platforms.[2]

## 2. THE PROCESS OF DATA ANALYSIS

### 2.1 ACQUIRING DATA

The first step in the data science process is to acquire the data you need to obtain the source material before analyzing or acting on it. To this regard, the acquiring data is to determine what data is available.

Data acquisition has been understood as the process of gathering, filtering, and cleaning data before the data is put in a data warehouse or any other storage solution. There are several methods of acquiring data:

- Collecting new data.
- Using your own previously collected data.
- Reusing someone other data.
- Purchasing data.
- Acquired from the Internet (texts, social media, photos).

## 2. THE PROCESS OF DATA ANALYSIS

### 2.2 EXPLORING DATA

Data exploration refers to the initial step in data analysis in which data analysts use data visualization and statistical techniques to describe dataset characterizations, such as size, quantity, and accuracy, in order to better understand the nature of the data.

In data mining, Exploratory Data Analysis (EDA) is used for seeing what the data can tell us before the modelling task.

Exploratory data analysis is generally cross-classified in two ways. First, each method is either **non-graphical** or **graphical**. And second, each method is either **univariate** or **multivariate** (usually just bivariate) [3].

## 2. THE PROCESS OF DATA ANALYSIS

### 2.3 PRE-PROCESSING DATA

The data pre-processing is the set of methods and techniques used to discover knowledge from the data before the data mining process.

#### MAJOR TASKS IN DATA PRE-PROCESSING



*Major Tasks in Data Pre-processing. Source:*  
<https://www.analyticsvidhya.com/blog/2021/08/data-preprocessing-in-data-mining-a-hands-on-guide/>

## 2. THE PROCESS OF DATA ANALYSIS

### 2.3 PRE-PROCESSING DATA

#### **DATA CLEANING**

Data cleaning is the process to remove incorrect data, incomplete data and inaccurate data from the datasets, and it also replaces the missing values.

#### **DATA INTEGRATION**

The process of combining multiple sources into a single dataset. The Data integration process is one of the main components in data management.

#### **DATA REDUCTION**

This process helps in the reduction of the volume of the data which makes the analysis easier yet produces the same or almost the same result. This reduction also helps to reduce storage space.

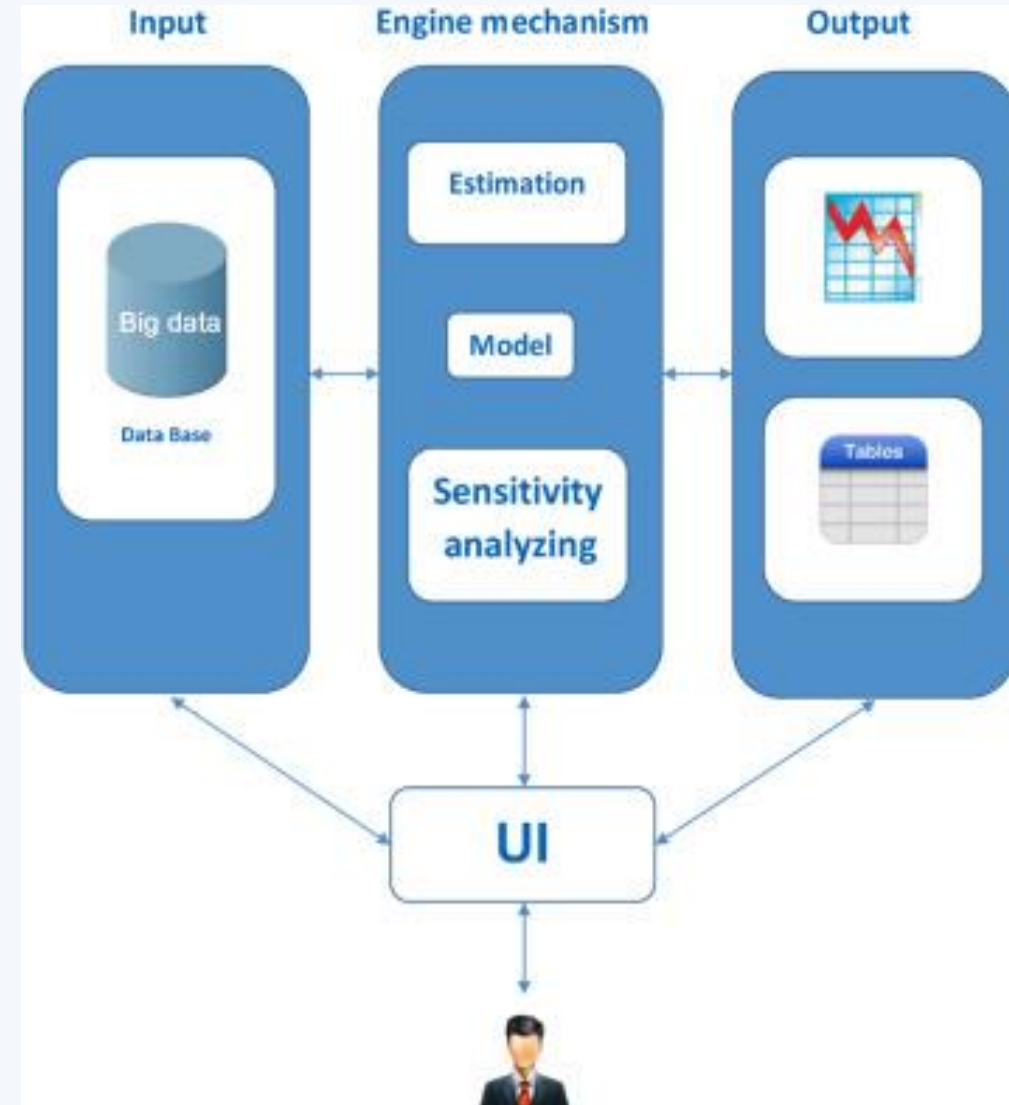
#### **DATA TRANSFORMATION**

The change made in the format or the structure of the data is called data transformation. This step can be simple or complex based on the requirements [4].

## 2. THE PROCESS OF DATA ANALYSIS

### 2.4 ANALYSING DATA

Data analysis involves building a model from the dataset, which is called input data. The input data is used by the analysis technique to build a model. What the model generates is the output data.



Data analysis scheme. Source:

<https://www.sciencedirect.com/science/article/pii/B9780128153680000038>



## 2. THE PROCESS OF DATA ANALYSIS

### 2.4 ANALYSING DATA

Before diving into the five essential types of Data Analysis methods, it is important that we go over through the main analysis categories:

- Descriptive analysis - What happened.
- Exploratory analysis - How to explore data relationships.
- Diagnostic analysis - Why it happened.
- Predictive analysis - What will happen.
- Prescriptive analysis - How will it happen.

Starting with the category of descriptive up to prescriptive analysis, the complexity and effort of data evaluation increases, but also the added value for the company.

## 2. THE PROCESS OF DATA ANALYSIS

### 2.4 ANALYSING DATA

There are different types of problems, and so there are different types of analysis methods:

#### **CLUSTER ANALYSIS**

The action of grouping a set of data elements in a way that said elements are more similar to each other than to those in other groups – hence the term ‘cluster.’ Since there is no target variable when clustering, the method is often used to find hidden patterns in the data.

#### **COHORT ANALYSIS**

This type of data analysis method uses historical data to examine and compare a determined segment of users' behaviour, which can then be grouped with others with similar characteristics. By using this methodology, it's possible to gain a wealth of insight into consumer needs or a firm understanding of a broader target group.

#### **DATA MINING**

A method of data analysis that is the umbrella term for engineering metrics and insights for additional value, direction, and context. By using exploratory statistical evaluation, data mining aims to identify dependencies, relations, patterns, and trends to generate advanced knowledge.

## 2. THE PROCESS OF DATA ANALYSIS

### 2.4 ANALYSING DATA

#### REGRESSION ANALYSIS

Regression uses historical data to understand how a dependent variable's value is affected when one (linear regression) or more independent variables (multiple regression) change or stay the same. By understanding each variable's relationship and how they developed in the past, you can anticipate possible outcomes and make better decisions in the future.

#### NEURAL NETWORKS

The neural network forms the basis for the intelligent algorithms of machine learning. It is a form of analytics that attempts, with minimal intervention, to understand how the human brain would generate insights and predict values. Neural networks learn from each and every data transaction, meaning that they evolve and advance over time [5].

### 2.5 REPORTING INSIGHTS

The fifth step of the data analytics process is to share insights gained from the analysis. This is a very important step to communicate your insights and make a case for what actions should follow. This is more complex than simply sharing the raw results of your work—it involves interpreting the outcomes, and presenting them in a manner that's digestible for all types of audiences. This report includes:

- Customer/Industries centric outcomes.
- Strategy and decision tree for the industries.
- Identification of business priority.
- Identification of target audience or consumers for the products.
- business case based on measurable outcomes [6].

## 2. THE PROCESS OF DATA ANALYSIS

### 2.6 TURNING INSIGHTS INTO ACTION

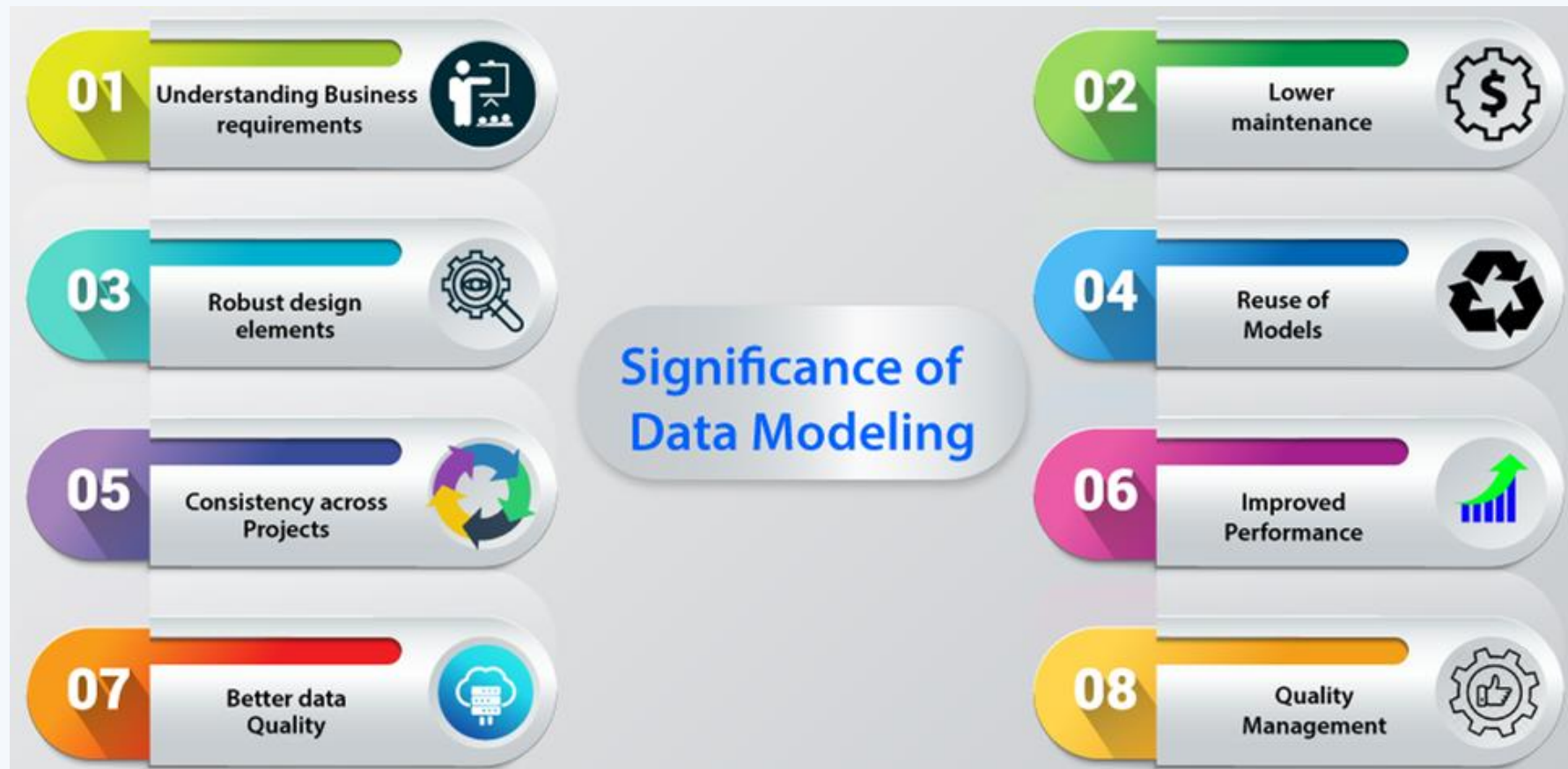
The last step is to determine what action or actions must be taken, based on the insights gained.

The way of interpreting and presenting results will often influence the direction of a business. Depending on the reporting insights, an organization might decide to restructure, launch a high-risk product, or even close an entire division.

Marketers who analyse customer data for vital insights on customer-centric strategies gain a competitive advantage. Brands can now effectively reach out to the right audience with the right message and at the right time. Brands are able to reach effectively as a result of proper insights generated from this data [7].

### 3. INTRODUCTION TO BIG DATA MODELLING AND MANAGEMENT

When we have massive amounts of data, we need a system or a method to keep everything in order. The process of sorting and storing data is called "data modelling".





### 3. INTRODUCTION TO BIG DATA MODELLING AND MANAGEMENT

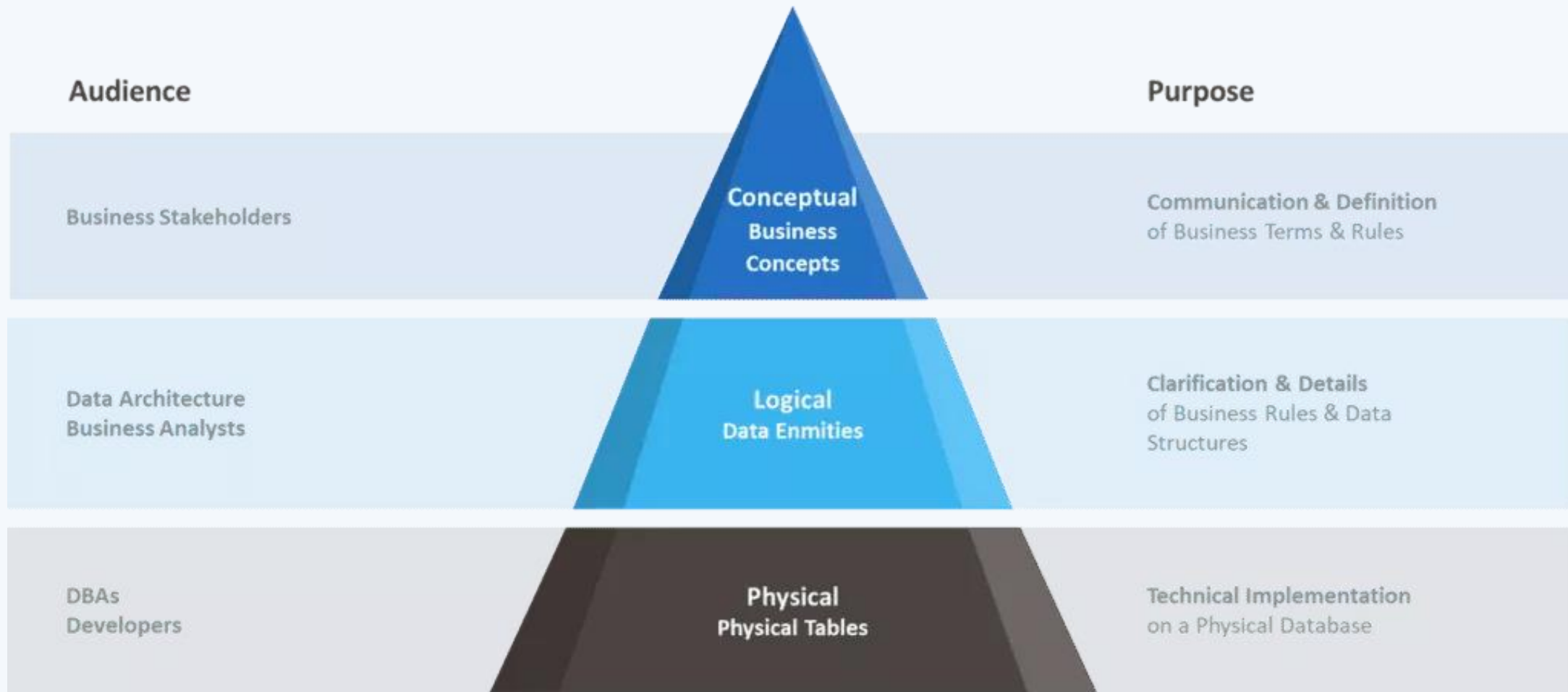


The concept of Big Data modelling includes two software terminologies within it, namely 'Data modelling' and 'Big Data'. The term 'Big Data' refers to the large amounts of data produced by companies in the modern contemporary world. This kind of data is devoid of any constant pattern and is complex by nature. It becomes impossible for companies to analyse this data in traditional methods.

These complex data types can be analysed using high-quality data modelling methods. In this context, it has to be understood that the term 'Data modelling' implies the method of organizing the data in such visualized patterns that the process of data analysis can be performed with ease. The techniques include the process of making visual representations of the whole or part of the datasets.[8]

### 3. INTRODUCTION TO BIG DATA MODELLING AND MANAGEMENT

#### DIFFERENT TYPES OF DATA MODELLING:



## Big Data Modeling

Big Data Modelling types. Source: <https://www.epcgroup.net/big-data-modeling/>

### 3. INTRODUCTION TO BIG DATA MODELLING AND MANAGEMENT

#### **CONCEPTUAL DATA MODELLING**

As the term suggests, this kind of data modelling is functional in an organization that is in the conceptual stage of its formation. In this situation, the user company attempts to organize the raw data to establish the goals. You can also set achievement standards that you wishes to actualize. The conceptual data modelling function is performed by business analysts to give the investors a brief idea of the relevant datasets and their relation to one another.

#### **LOGICAL DATA MODELLING**

This term refers to the process of creating a graphical representation of the information depicted within the conceptual data models. The difference between the conceptual and logical patterns of data modelling is that in the latter, there is an addition of definitions, illustrated concepts and others which increase the understanding of the data within these models.

#### **PHYSICAL DATA MODELLING**

The choice of physical data modelling method is made by a company based on the functional requirements that are dependent on the data. The data models built using this method have a basis in a specific database management system [8].

### 3. INTRODUCTION TO BIG DATA MODELLING AND MANAGEMENT

#### METHODS OF DATA MODELLING:

Data modelling can be performed mainly in two kinds of systems, namely, **OLTP** (Online Transaction Processing) and **OLAP** (Online Analytical Processing).

As the terms suggest, the data modelling patterns are supposed to be different for the two systems. A competitive analysis of the two methods would be required to understand the differences clearly.

To begin with, the data operating system in the OLTP is a random read or write procedure. On the other hand, the basic data operation system in the OLAP follows the batch read or write procedure. While the OLTP system focuses on the entity-relationship model, the OLAP system concentrates on data integration.

Finally, the OLTP system focuses on solving issues like data redundancy, transactional inconsistency. The OLAP on the other hand focuses on big data query performance [8].

### 3. INTRODUCTION TO BIG DATA MODELLING AND MANAGEMENT



#### TECHNIQUES OF DATA MANAGEMENT:

Data management plays several roles in an organization's data environment, making essential functions easier and less time-intensive. These data management techniques include the following:

- Data preparation is used to clean and transform raw data into the right shape and format for analysis, including making corrections and combining data sets.
- Data pipelines enable the automated transfer of data from one system to another.
- ETLs (Extract, Transform, Load) are built to take the data from one system, transform it, and load it into the organization's data warehouse.

### 3. INTRODUCTION TO BIG DATA MODELLING AND MANAGEMENT



#### TECHNIQUES OF DATA MANAGEMENT:

- Data catalogues help manage metadata to create a complete picture of the data, providing a summary of its changes, locations, and quality while also making the data easy to find.
- Data warehouses are places to consolidate various data sources, contend with the many data types businesses store, and provide a clear route for data analysis.
- Data governance defines standards, processes, and policies to maintain data security and integrity.
- Data architecture provides a formal approach for creating and managing data flow.
- Data security protects data from unauthorized access and corruption.
- Data modeling documents the flow of data through an application or organization [9].



## 4. REAL BIG DATA MANAGEMENT APPLICATIONS

In this section, some real examples of the use of Big Data will be proposed, showing how the technologies explained during the course are implemented in real industrial environments.

### 4.1 HEALTHCARE

Big data in healthcare is a term used to describe massive volumes of information created by the adoption of digital technologies that collect patients' records and help in managing hospital performance, otherwise too large and complex for traditional technologies.

The application of big data analytics in healthcare has a lot of positive and also life-saving outcomes. In essence, big-style data refers to the vast quantities of information created by the digitization of everything, that gets consolidated and analyzed by specific technologies. Applied to healthcare, it will use specific health data of a population (or of a particular individual) and potentially help to prevent epidemics, cure disease, cut down costs, etc. [10]

## 4. REAL BIG DATA MANAGEMENT APPLICATIONS

### 4.1 HEALTHCARE

Some real-world applications that demonstrate how an analytical approach can improve processes, enhance patient care, and, ultimately, save lives:



Figure 8: Big Data Applications in Healthcare. Source: <https://www.datapine.com/blog/big-data-examples-in-healthcare/#:~:text=our%20top%20examples!-,What%20is%20Big%20Data%20in%20Healthcare%3F,and%20complex%20for%20traditional%20technologies>

## 4. REAL BIG DATA MANAGEMENT APPLICATIONS

### 4.2 EDUCATION

Big data is transforming how schools analyse information and make decisions in areas such as academic performance, faculty effectiveness, organizational outreach, and technology efficiency.

#### **ACADEMIC PERFORMANCE**

Professors use data to assess student performance. The data may reveal potential opportunities for increased engagement. For example, faculty teams can analyse attrition rates, total enrolment for courses, and student success to improve instructional design.

#### **FACULTY EFFECTIVENESS**

Faculty can use the insights gleaned from big data analysis to create better learning environments and to more effectively evaluate their lessons and courses. For example, analytics tools can provide data about students' wrong answers on tests and the time they took to complete a task. This provides vital information that allows faculty to adjust their instruction as needed. Through a feedback loop, detailed input from students can help ensure optimal output for students in future semesters.

## 4. REAL BIG DATA MANAGEMENT APPLICATIONS

### 4.2 EDUCATION

#### ORGANIZATIONAL OUTREACH

A college using recruitment tools such as customer relationship management (CRM) software can track the activity of prospective students across the web, through social media, and on mobile devices. If a prospect visits a college's advertisement or webpage, the CRM tool can use "cookies" (data about the user stored by a web browser) to retarget ads to that prospect on other websites. This can help increase enrolment and generate revenue through tuition dollars.

#### TECHNOLOGY EFFICIENCY

Big data in education can also play a central role in improving the campus's financial and business operations systems. The result can include enhanced efficiency and productivity. For example, analysis of campus network logs can reduce response times for service desk requests [11].

## 4. REAL BIG DATA MANAGEMENT APPLICATIONS

### 4.3 MANUFACTURING AND NATURAL RESOURCES

Various kinds of manufacturing industries including aerospace and defence companies, auto manufacturers, heavy equipment manufacturers, electronics companies, oil and gas companies, and other organizations that produce consumer and capital goods are adopting Big Data advanced analytics to gain the benefits most suited for them.

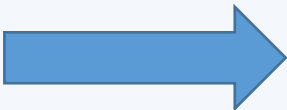
Apart from the traditional source of big data like conducting online marketing analysis, regulated loyalty programs and social media monitoring the industries can use other software machines to collect such data.

They use a variety of manufacturing software within the company, like MES, CRP, CMMS etc. and these systems are integrated with machines like machines such as assets like sensors, pumps, motors, compressors, or conveyors to be able to generate big data in the manufacturing industry [12].

# 4. REAL BIG DATA MANAGEMENT APPLICATIONS

## 4.3 MANUFACTURING AND NATURAL RESOURCES

APPLICATIONS OF BIG DATA  
IN MANUFACTURING INDUSTRY



Big Data Applications in Manufacturing Industry. Source: <https://www.analyticssteps.com/blogs/10-applications-big-data-manufacturing>



## 4. REAL BIG DATA MANAGEMENT APPLICATIONS



### 4.4 RETAIL AND WHOLESALE TRADE

Retail and wholesale analytics is the process of using big data to optimize pricing, supply chain movement, and improve customer loyalty. For the retail industry, big data means a greater understanding of consumer shopping habits and how to attract new customers. Big data analytics in retail enables companies to create customer recommendations based on their purchase history, resulting in personalized shopping experiences and improved customer service. These super-sized data sets also help with forecasting trends and making strategic decisions based on market analysis.

## 4. REAL BIG DATA MANAGEMENT APPLICATIONS

### 4.4 RETAIL AND WHOLESALE TRADE

#### PREDICTING SPENDING

For example Amazon uses customer data to recommend items based on costumers past searches and purchases. They generated 29 percent of sales through their recommendations engine which analyses more than 150 million accounts. This has led to big profits for the ecommerce giant.

#### PERSONALIZING CUSTOMER EXPERIENCE

For retailers, big data can create opportunities to provide better customer experiences. E.g. Costco uses their transaction data collection to keep customers healthy. When a California fruit packing company warned Costco about the possibility of listeria contamination in fruits like peaches and plums, Costco was able to email specific customers who had purchased the items affected by the contamination instead of a blanket email to their lists.

#### FORECASTING DEMAND IN RETAIL

In addition to big data, some algorithms analyse social media and web browsing trends to predict the next big thing in the retail market.

## 4. REAL BIG DATA MANAGEMENT APPLICATIONS

### 4.4 RETAIL AND WHOLESALE TRADE

#### MANAGING MULTIPLE LOCATIONS OF RETAIL CHAINS

Retail chains and retail businesses can use analytics to understand the differences in demand for their product across various geographic locations. Using consumer spending analytics, retailers can use this data to better service customers in specific regions and also stock products more efficiently.

#### CUSTOMER JOURNEY ANALYTICS

The customer journey is not a straight line. It's a zig-zag across channels from research to purchase. The only way to get a handle on the customer journey and create better experiences is to use big data. Analytics solutions can help retailers answer questions such as: Where are customers actually looking for product information? Where are we losing them? What are the most effective ways to reach them and compel them to purchase? [13]

### BIG DATA CASE STUDY – WALMART



Big Data Case Study – Walmart. Source: <https://www.massmarketretailers.com/big-data-key-to-walmart-strategy/big-data-walmart/>

Walmart is the largest retailer in the world and the world's largest company by revenue, with more than 2 million employees and 20.000 stores in 28 countries. It started making use of big data analytics much before the word Big Data came into the picture.

## 5. PRACTICAL REAL CASE



### BIG DATA CASE STUDY – WALMART

Walmart uses **Data Mining** to discover patterns that can be used to provide product recommendations to the user, based on which products were brought together.

By applying effective Data Mining WalMart has increased its conversion rate of customers. It has been speeding along big data analysis to provide best-in-class e-commerce technologies with a motive to deliver superior customer experience.

The main objective of holding big data at Walmart is to optimize the shopping experience of customers when they are in a Walmart store.

## 5. PRACTICAL REAL CASE

### BIG DATA CASE STUDY – WALMART

Big data solutions at Walmart are developed with the intent of redesigning global websites and building innovative applications to customize the shopping experience for customers whilst increasing logistics efficiency.

Hadoop and NoSQL<sup>1</sup> technologies are used to provide internal customers with access to real-time data collected from different sources and centralized for effective use.

**READ ARTICLE →** *How Big Data Analysis helped increase Walmarts Sales turnover?*



<https://www.projectpro.io/article/how-big-data-analysis-helped-increase-walmarts-sales-turnover/109#toc-4>

<sup>1</sup>Hadoop and NoSQL are open source frameworks that are used to efficiently store and process large datasets ranging in size from gigabytes to petabytes of data



## ADDITIONAL READINGS

### INTERESTING AND COMPLEMENTARY ARTICLES/PAPERS/VIDEOS ABOUT BIG DATA

- Big Data & Hadoop Full Course - Learn Hadoop In 10 Hours | Hadoop Tutorial For Beginners | Edureka  
<https://www.youtube.com/watch?v=1vbXmCrkT3Y>



- Big Data Tutorial For Beginners | What Is Big Data | Big Data Tutorial | Hadoop Training | Edureka  
<https://www.youtube.com/watch?v=zez2Tv-bcXY>



- Aisha Siddiga, Ahmad Karim, Abdullah Gani, 2017. Big data storage technologies: a survey. in Frontiers of Information TEchnology & Electronic Engineering. 18, 10-40-1070(2017) <https://link.springer.com/article/10.1631/FITEE.1500441>

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[10] Sandra Durcevic, “18 Examples Of Big Data Analytics In Healthcare That Can Save People”, [Online]. Available in: <https://www.datapine.com/blog/big-data-examples-in-healthcare/#:~:text=our%20top%20examples!-,What%20Is%20Big%20Data%20In%20Healthcare%3F,and%20complex%20for%20traditional%20technologies>. [Accessed on 31/08/2022]

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Your Text Here

# Fostering diGitalisation and blonic transformation of SMEs through the development of a novel and innovative Training material for overcoming COVID-19 crisis

[HTTPS://GIST-PROJECT.EU/](https://gist-project.eu/)



**Thank  
you**

# TU.2

# LU. 8

**TRAINING UNIT 2 – SOFT SKILLS FOR BIONIC TRANSFORMATION**

**LEARNING UNIT 8- BRAINSTORMING & COMMUNICATION**

Your Text Here



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- 1. Introduction to brainstorming and communication
- 2. Brainstorming
  - 1.1. What is brainstorming
  - 1.2. Basic rules of brainstorming
  - 1.3. Brainstorming principles
  - 1.4. Brainstorming techniques and tools
  - 1.5. Tips for brainstorming
  - 1.6. Online brainstorming
- 3. Communication
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  - 2.2. Components
  - 2.3. Types of communication
  - 2.4. Tips to improve your communication skills
  - 2.5. Techniques and strategies for efficient communication
  - 2.6. The art of asking questions
  - 2.7. Types of conversation
  - 2.8. Non-violent communication



*Communication. Source: Freepik*

# 1. INTRODUCTION TO BRAINSTORMING AND COMMUNICATION



This module will explore brainstorming and communication. It will present the principles and different methods and tools of brainstorming. These are the highlights that one can look forward to in this module: discovering how tools, rules, and tips can help with brainstorming and exploring how to approach and benefit from virtual brainstorming. The module will present how to deal with brainstorming session either face-to-face or virtual.

This module will also include information and knowledge needed to distinguish different types and components of communication and rules of nonviolent communication. The aim of this module is to provide tools to understand what others want and respond to their needs by using nonviolent communication. Techniques and strategies for efficient communication and the art of asking questions will be also described with the emphasis put on effective communication at work and how to achieve communication goals. Asking appropriate questions and developing trust is another subject that will be explored in this module as well as improving the communication skills.

## 2. BRAINSTORMING

### 2.1. WHAT IS BRAINSTORMING?

Brainstorming is a method of generating ideas and sharing knowledge to solve clearly defined design problems. It is a perfect tool for idea generation in controlled conditions and a free-thinking environment. Teams produce a vast array of ideas and draw links between them to find potential solutions to a given problem or issue.



Business team discussing ideas. Source: Freepik

### 2.2. BASIC RULES OF BRAINSTORMING

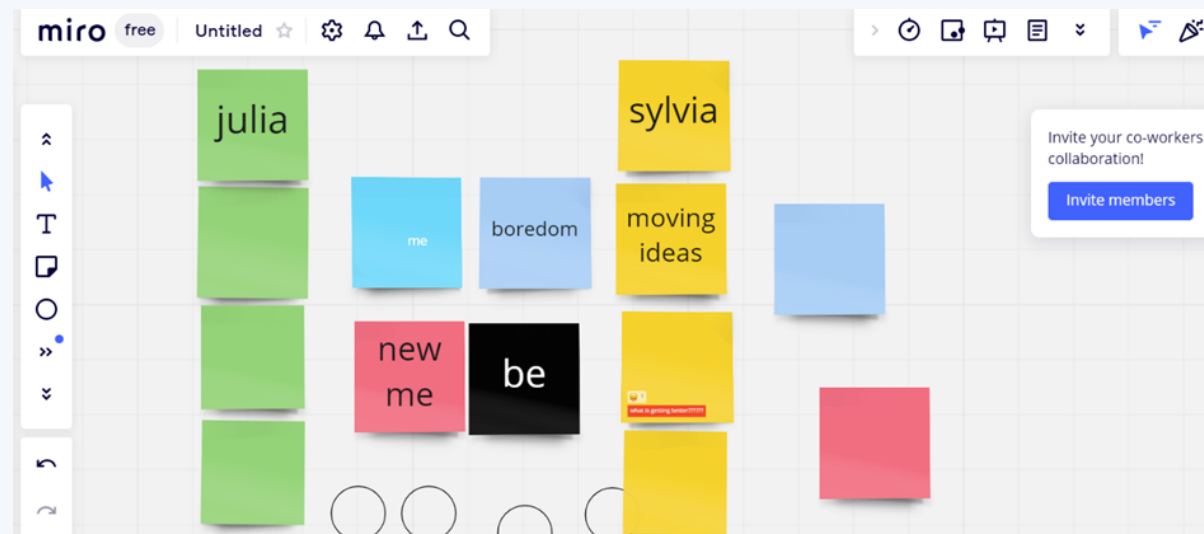
Brainstorming can be led and managed without many constraints, but it is advisable for a facilitator of a brainstorming session to follow some basic rules.

1. The best brainstorming session should be no longer than 60 minutes, but they can last only 15 minutes. Brainstorming sessions can be divided into smaller pieces, participants should be always informed about the time of the session and how much time they have till the end of the session.
2. Plan a session as a facilitator, set a goal and the main question to answer, keep with your target problem, and you should have a clear purpose for the brainstorming session.
3. The more information you can provide about the problem, the better your brainstorming will go.
4. If you want to brainstorm virtually you can simply use Google Hangout, Microsoft Teams, or Zoom. But there are plenty of other tools you can use, for instance, Miro.
5. Try to find people with different backgrounds and experiences for your brainstorming session, the more diversity the better. People coming from different sectors, education can have a completely different point of view that makes a brainstorming session abundant in unexpected ideas.
6. Involve and invite free participation without judgments, assessments, comments, anybody should feel free to give ideas. Sometimes a virtual brainstorming session using software like Miro may help overcome shyness of some participants.

## 2. BRAINSTORMING

### 2.2. BASIC RULES OF BRAINSTORMING

7. Encourage participants to be creative. They can use their imagination to the extend to reach the most unexpected ideas and Solution.
8. The more ideas they have the better. Encourage participants to give a lot of ideas.
9. Use post it notes, diagrams, colorful pencils, make it colorful and graphic.
10. Ask participants to build additional ideas on the basis on the ideas of other participants
11. Remind them to show respect to other participants ideas
12. That's why it's important to leave the brainstorm session with a set of takeaways which are clear to all the attendees. Make sure everyone is aligned on the next steps and add some milestones for the development of the ideas which have emerged from the problem-solving process.



Brainstorming. Source: based on Miro [www.miro.com](http://www.miro.com)

## 2. BRAINSTORMING

### 2.3. BRAINSTORMING PRINCIPLES

Brainstorming is considered as a free-form creative thinking exercise, but there are basic principles to brainstorming, and not every idea-generating exercise is a brainstorm. Brainstorming sessions must follow some principles to be productive.

1. Emphasis on quantity rather than quality of ideas,
2. Criticism of another person's idea is strictly forbidden
3. Involve interdisciplinary teams



Brainstorming session. Source: Freepic



## 2. BRAINSTORMING

### 2.4. BRAINSTORMING TECHNIQUES AND TOOLS

**Flip chart** is the most common and basic brainstorming tool. It can be used as a starting point for idea generation. To use the flip chart a facilitator should define a problem and be sure that the participants have pens and drawing Surface. It can be used for the whole group or for participants divided into smaller groups. Flip Charts are a great entry activity to a brainstorming session, but they are a one-sided approach with a single facilitator that records the ideas.



*Source: Photo by Studio VIX on Unsplash*



**Post-its notes** is another perfect and simple tool to use for brainstorming. It can be used by groups where each participants develop his or her ideas individually and the ideas can be freely rearranged on the Surface which gives an additional advantage to the tool. The facilitator can also invite the group to categorize the ideas by rearranging the post- it notes.

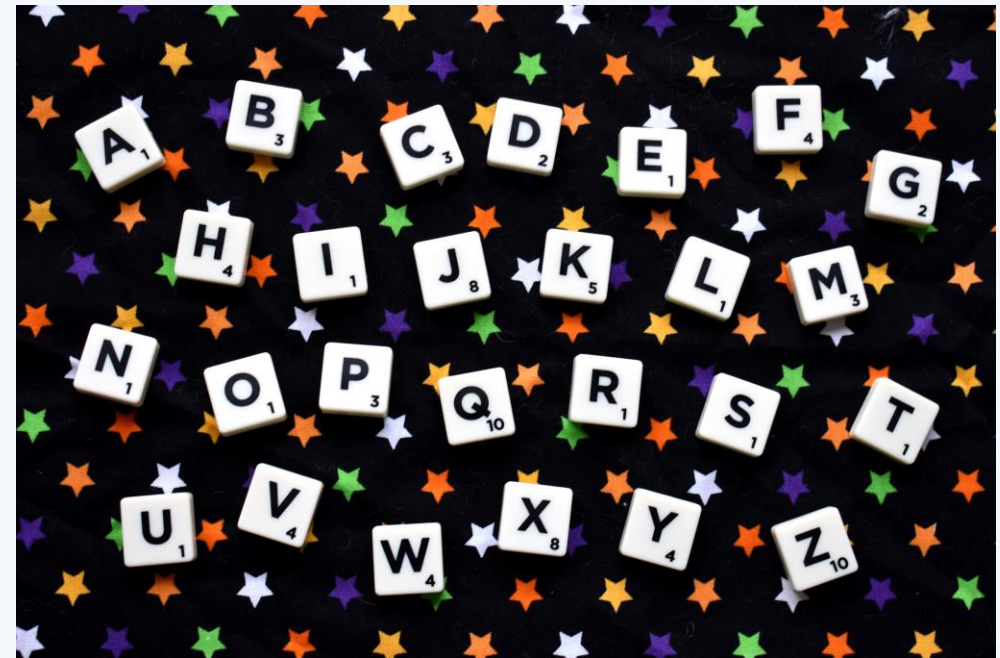


Source: Photo by Hugo Rocha on Unsplash

## 2. BRAINSTORMING

### 2.4. BRAINSTORMING TECHNIQUES AND TOOLS

**Alphabet Brainstorming** is a tool for a brainstorming session where participants are invited to work through the alphabet letter by letter. The facilitator can encourage participants to gather sentences beginning on each letter rather than only a single word. With one set parameter, the letter itself, it inspires a wide range of ideas. It also encourages the creative use of the letter to form a sentence or phrase, rather than an idea that is one or two words.



Source: Photo by Jessica Hast on Unsplash

### 2.4. BRAINSTORMING TECHNIQUES AND TOOLS

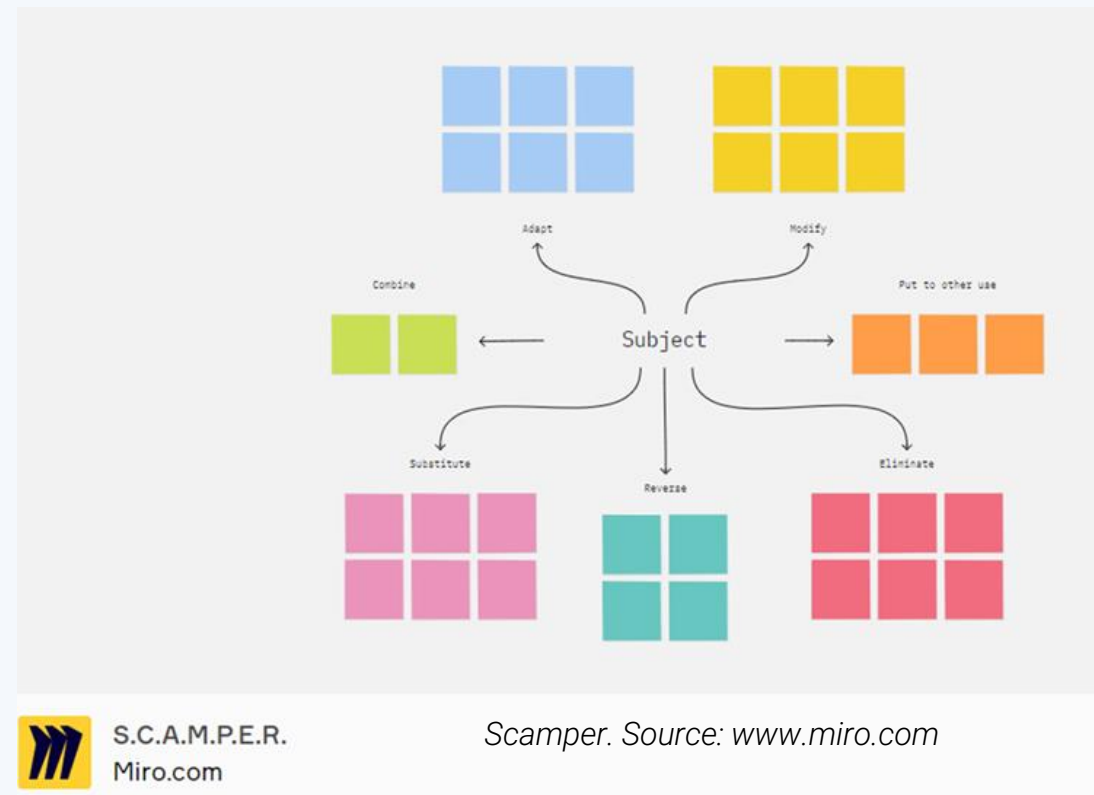
**Brainstorming Grid** is a technique which make a grid and fills in the top header row and the first column with the same idea and then move along. Each participant must suggest an idea and add it to the grid. Then they combine ideas one from each row. If you start with 4 ideas, you'll have 16 new ones just by combining them.

**Brainwriting** is a perfect technique to use online where everybody can silently participate and explore his or her ideas. Brainwriting was developed by Horst Geschka at the Batelle Institute in Frankfurt (Geschka, 1993). Most of the session is done in silence as it encourages a group of participants to develop ideas in parallel. Miro can be a perfect tool for brainwriting. A modification is a Brainwriting 6-3-5 which is a modified form of classic brainstorming that encourages equal participation from all team members, the general process is that all ideas are recorded by the individual who thought of them. They are then passed on to the next person, who uses them as a trigger for their ideas. A facilitator of a brainwriting session asks participants to read the card received and see if it inspires an idea (several idea cards will be being passed around the group). Cards are collected after 10-20 minutes and reviewed collectively, grouped and participants may share their favourite ideas or even assign some points to 3-5 favourite ones.

## 2. BRAINSTORMING

### 2.4. BRAINSTORMING TECHNIQUES AND TOOLS

**SCAMPER** is a technique you can use to spark your creativity and help you with any challenge in your life. It assumes that everything is a modification of something that already exists. It is a checklist with idea-gathering questions. It was created by Bob Eberle in the early 70s. Basic Summary: SCAMPER = Substitute, Combine, Adapt, Modify, Put to different use, Eliminate, Reverse. Learners use a set of questions to help evolve an existing problem, project or solution into one that is more ideal.



### 2.4. BRAINSTORMING TECHNIQUES AND TOOLS

You can solve, for instance, this problem using SCAMPER by asking your students: “How can we make this product bionic?”

Following the SCAMPER recipe, here are a few questions you could ask:

- S (Substitute): “What can we substitute in this product to make it bionic?”
- C (Combine): “How can we combine it with different materials or products?”
- A (Adapt): “What can we adapt from different Solutions or copy?”
- M (Magnify): “What should we especially focus on?”
- P (Put to Other Uses): “Can we use it for different purposes, different uses?”
- E (Eliminate): “What is not necessary, what can be limited, replaced?”
- R (Rearrange): “How can we rearrange the material and components?”

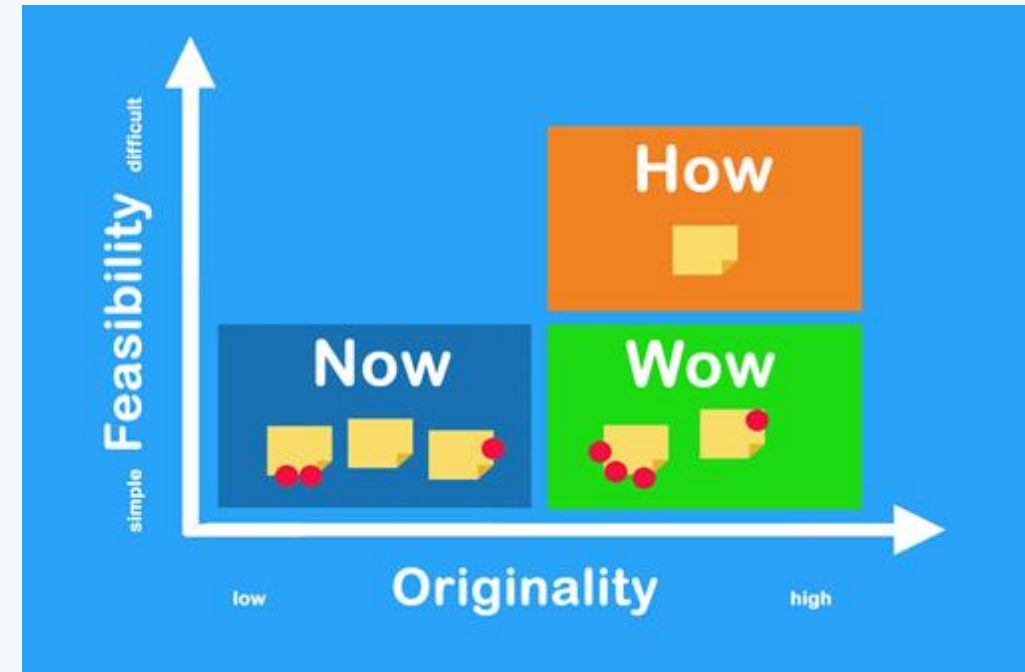


## 2. BRAINSTORMING

### 2.4. BRAINSTORMING TECHNIQUES AND TOOLS

The **How Now Wow matrix** is a tool for brainstorming ideas and grouping them following the two characteristics, they are easy to implement (feasible) or original.

The How ideas are ideas that are innovative but not ready to implement, they require more knowledge and time. Now are ideas that are ready to implement, and Wow are creative ideas that are also easy to implement. The tool can be used for online teaching using Miro tool.



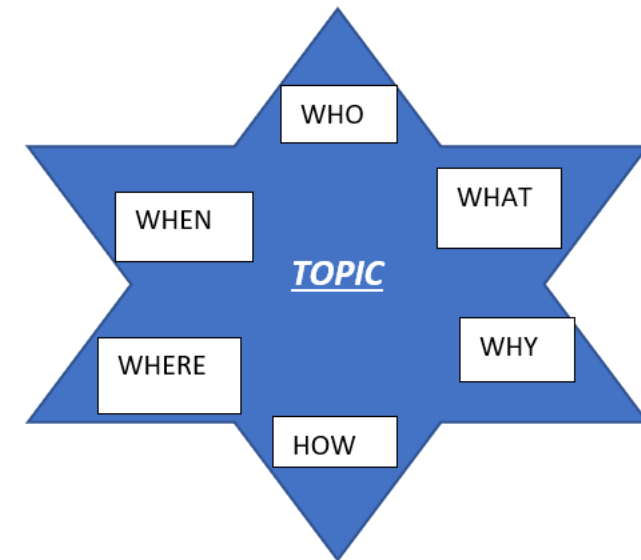
How Now Wow matrix. Source:  
<https://t2informatik.de/en/smartpedia/how-now-wow-matrix/>

## 2. BRAINSTORMING

### 2.4. BRAINSTORMING TECHNIQUES AND TOOLS

**Starbursting** is type of brainstorming to generate questions before participants generate ideas. It appears easier to implement as people are usually more eager to ask questions and search for problems rather than solutions. It is based on six questions related to formulated topic, problem, idea, challenge, project, or product. The following questions need to be answered: Who? What? When? Where? Why? How?

It is important for starbursting to introduce the method to participants and its rules, and the topic and fix a time for each part of the session. First, participants get the topic, then they generate questions and afterward answers and solutions.



*Starbursting. Source: GIST Project*

## 2. BRAINSTORMING

### 2.4. BRAINSTORMING TECHNIQUES AND TOOLS

**Step-ladder technique** is a type of brainstorming that gives the chance to participants who are more silent and quieter in the group. The procedure is that a facilitator introduces the topic, 2 participants stay in the room and the rest leaves the room. These 2 people brainstorm together and then the third person comes into the room and that person shares his or her ideas with these two participants who stayed in the room. Then they share their ideas altogether. Outside the room, the other participants continue to brainstorm and write down ideas in group or individually, but they should not discuss their ideas with anyone until they are inside the room. In the Step-ladder method it is possible to implement also virtual brainstorming (a facilitator can divide participants into a virtual rooms).



*Step-ladder. Source: Freepic*

## 2. BRAINSTORMING

### 2.5. TIPS FOR BRAINSTORMING

- Invite participants
- Thank participants at the end
- Use icebreakers
- Define the brief of any brainstorming session (make introduction, prepare handouts)
- Distribute the brief to the participants in advance of the session
- Ask participants to participate with an open mind, think out of the box
- Any unusual idea can't turn into a great idea

## 2. BRAINSTORMING

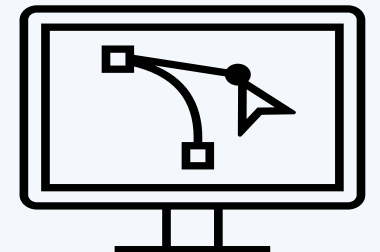
### 2.6. ONLINE BRAINSTORMING

A lot of software and tools are available for online brainstormings. For example, Google docs allows team members to write down their ideas whenever they are inspired, for people in different timezones, and different places. Another option can be WeWork, collaboration tools like Slack, and Miro's online whiteboard. It can be very challenging for some groups of learners, but it may also cause a lot of fun. Brainstorming is a technic that unlocks your creativity as a participant in a brainstorming session is not judged and they can explore their potential for ideas.

The rules regarding virtual brainstorming as well as principles are the same as for face-to-face but virtual brainstorming might be a challenge for some groups.

While preparing for the virtual brainstorming some critical points should be taken into account:

- The goal of the brainstorming session should be very precise, precise problems, solutions to find in order not to make participants feel that they are wasting their time.
- Define the expectation of the brainstorming session.
- The problem might be the low engagement of participants because of distance but still some participants, more introverts can benefit from online sessions and give more than on face-to-face sessions, a Miro introduces an involving whiteboard.
- Virtual brainstorming sessions require well prepared facilitator and good organisation.



## 2. BRAINSTORMING

### 2.6. ONLINE BRAINSTORMING

#### STEPS OF AN ONLINE BRAINSTORMING

Before the virtual session:

- Send out questions to give participants time for preparation
- Send an agenda
- Select a digital whiteboard that you can use to facilitate the meeting

During the session:

- Use an online whiteboard to record your notes, facilitate discussion
- Allow participants to communicate by using their microphones, the chat box, sticky notes, or sketching
- Use ice breaker, quizzes and games to trigger engagement

After the virtual brainstorming:

- Thank participants, invite them to the next virtual session and send out the summary, notes and reminders for further activities



### 3.1. The Concept of communication

The root of the word "communication" in Latin is *communicare*, meaning to signify yourself or to make an explanation (Weekley, 1967). Communication is related to the process of understanding and sharing meaning (Pearson and Nelson, 2000), it is the act of transferring information from one place, person, or group to another. Every communication involves (at least) one sender, a message, and a recipient.

Good communication means that when an interlocutor sends a message it is received without any distortion in meaning.

Communication is crucial in almost every aspect of effective organizations and teamwork. Organizations gather people with a variety of backgrounds, sectors, and organisational cultures. They are required to form a shared vision and understanding of problems, and they have to cooperate effectively to create a common value.

Effective internal communication mechanisms in companies and organizations are crucial to keeping all relevant parties well informed regarding all issues and processes. Determining what and how to communicate has huge importance in all management of an organisation.

## 3. COMMUNICATION

### 3.2. Components of communication

Essential components of each communication are:

- **Source/Sender** the person who is trying to communicate a message. He or she is a person who equips the message with a tone, gestures and it determines the communication.
- **The message** “The message is the stimulus or meaning produced by the source for the receiver or audience.” (McLean, 2005). A message is also your tone of voice, your body language, and your appearance and it can be also written so the style, pronunciation, and grammar. Even when no words are spoken, communication is taking place.



*The message. Source: freepik.com*

### 3.2. Components of communication

- **Channel** is a medium used for communication, it can be email, speech, a letter, telephone communication,
- **The receiver** is a person who receives the message and translates the words into thoughts, processes the thoughts, and determines how to respond to the sender.
- **Feedback** is responding to the source, it can be verbal or nonverbal, intentional or nonintentional. Feedback is also asking for clarification from the receiver or to agree or disagree.
- **Environment** is the atmosphere, physical and psychological, where you send and receive messages.” (McLean, 2005) it can be for instance formal ( requiring a special dress code) or nonformal, it can be a room where communication takes place and
- **Context** is the setting of communication and expectations of both sender and receiver of the message.
- **Interference or noise** is anything that can interfere with communication or block the course of communication, a kind of distraction. The distraction can also be external such as external noise or internal such as stress.

### 3.3. Organisational communication

Organisational communication is a very effective and crucial tool in the management of different businesses, being present in all departments and among the different audiences that maintain contact with the organisation, either internally or externally. Moreover, communication contribute and enable all strategies and decisions of organizations, as well as their responses and actions, involving staff, management, consumers, partners, suppliers.

Communication should also express the mission and vision of the company and contribute to the achievement of company's goals. Choosing the appropriate communication type, time and language is a great challenge for the organization

### 3.4. Types of communication

There are different types of communication:

- **Verbal communication.** One of the most common forms of communication is verbal communication, which is characterised by the transmission of an idea or message using words (orally or in writing). Verbal communication can take many forms such as face-to-face conversations, group discussions, counseling, and telephone calls. Verbal communication can be divided into:
  1. Oral Communication, which happens through word of mouth, spoken words, and conversations, which is the process of verbally transmitting information and ideas from one individual or group to another. It can have a variety of forms: Face-to-face, telephone, conferences/video conferences and seminars, meetings or formal presentations.
  2. Written Communication happens through any word written. It can have a variety of forms: letters, references, report, newsletters or proposals.
- **Non-verbal communication.** It is usually understood as the process of communication through sending and receiving wordless messages. Much of non-verbal communication takes place through gestures, facial expressions, tone of voice, eye contact, physical proximity, etc.

Non-verbal messages are often unconscious to the speaker. Most non-verbal communication reveals attitudes and emotions as opposed to the verbal communication that is most used in expressing ideas. There are five types of non-verbal communication: Body Language, Facial Expression, Gestures such as hand movements, posture, Proxemics (Distance), Haptics (Touch).

## 3. COMMUNICATION

### 3.4. Types of communication



Verbal communication (oral). Source: freepik.com



Verbal communication (written). Source: freepik.com



Non-Verbal communication. Source: freepik.com



### 3.5. Tips to improve communication

Communication skills are one of the most important skills for any person. People should be aware of it and know how to improve and work on communication skills. Communication depend also on to whom we communicate and what is the context, which emotions influence our communication, and what are the feelings of recipients. Here are some examples and tips on how to improve your communication to be more sensitive, effective, and convincing.

- Use simple messages, short messages are easier to understand.
- Adjust your communication style: use formal and informal communication.
- Invite your listeners – ask for their opinions or comments, and feedback, and interact with your audience.
- Observe the language and body language of a person you are speaking with; it may give additional information about their message or position.
- Take time to respond, think a little and give yourself time, make a pause.
- Use different tone for different recipients of your message, you can be serious or encouraging, you can socialize with your listeners.
- Show empathy when it is needed and you feel it, people always want to be understood and it is important that you take people concerns seriously and you try to understand other people's points of views and situation.

### 3.5. Tips to improve communication

- Make sure you are understood, ask about that your listener, try to clarify again.
- Think about development of your listening skills that may help a lot with your communication skills Best communicator and best listener it is almost always the same person, if you can listen to other people, it means that you can also communicate effectively.
- Make a bespoke presentations while preparing for your audience. The message should fit the audience.
- Meet face- to -face if the topic is difficult and may cause some confusion. Do not communicate it by phone.
- Use body language as it influence our communication and can completely disturb your message while used in a wrong way.
- Always respect your audience – you should really care about your audience and show interest and pay attention to them.
- Eye contact is important while communicating with people. Always look at people you talk to. Do not avoid the eye contact as this may make people feel that you are not sincere.
- Plan for your presentation if you communicate in presentation mode, make visual aids.
- Use key phrases to help outline the major points in your talk. Good phrases to draw on attention include: **Moving on; My first point concerns...; First of all, I'd like to give you an overview of...; Next, I'll focus on.....and then we'll consider...; Then I'll go on to highlight what I see as the main points of...; Finally, I'd like to address the problem of...; Finally, I'd like to raise briefly the issue of...; To wrap things up...**

### 3.6. Techniques and strategies for efficient communication

Strategies for effective verbal communication:

- Focus on the subject/problem, not on the person.
- Be sincere and try not to take everything personally, express your own needs.
- Try to solve problems rather than attempt to control others.
- Use humor, do not be so serious as this often leads to negative reception and some receivers may want to leave the conversation, good joke can help people to relax.
- Be genuine and do not manipulate as people often know that somebody is manipulative, speak honestly and openly.
- Make some notes not to forget what you want to communicate and prepare yourself beforehand.

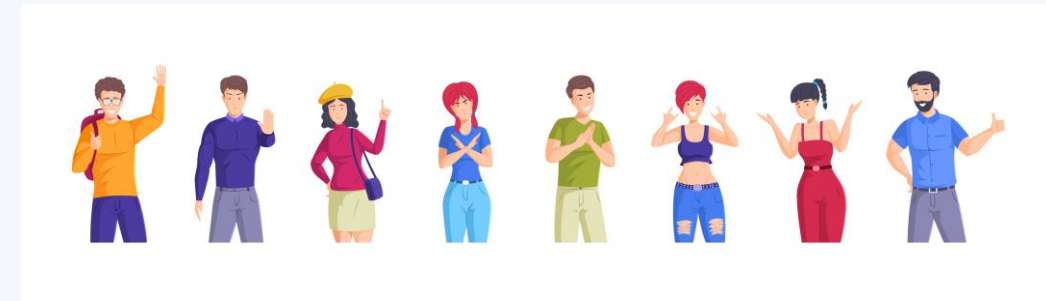


*Humour. Source: Freepik.com*

### 3.6. Techniques and strategies for efficient communication

Strategies for **effective verbal communication**:

- Remain emphatic, demonstrate sensitivity. Some formal situation may require very determined way of communication, but a small dose of sensitivity always helps.
- Try to remain flexible and open towards others, people may have different points of view, different backgrounds.
- Value yourself as it contribute to others valuing yourself.
- Thank other people for their input, points of view, acknowledge other people experience, Affirm their right to their disagreement.
- Express positive feelings and provide positive feedback .
- Be ready to participate yourself in difficult conversations, do not avoid them, do not argue, be gentle, try to understand other people.



*Communication. Source: Freepik.com*

### 3.7. The art of asking questions 1

One of the main goals of communication is gathering information. Skill of asking questions is a perfect tool for that. Asking questions is a great tool for checking if your listener understands your message. Experienced negotiators ask a lot of questions, they listen to the answers and in this way, they demonstrate concern for the other party. For some people asking questions is a part of their nature but other people find asking questions difficult. Questions improve our emotional intelligence, help in building relations and unlock learning. People who ask a lot of questions are more open to others and curious and appreciate the others point of views. They are simply interested in others.

Questions can play a very important role in the communication, not only gathering information. Questions can be also used to:

- Guide answers especially when the answer is uncertain – (for example: Do you eat sugar and how often?)
- Convey information

### 3.7. The art of asking questions 2

**Leading question** is a question that pushes respondents to answer in a specific way. Leading questions are led by a person who is asking. Leading questions contain also information that the asking person wants to receive rather than get a true and an unbiased answer to that question.

There are the following leading questions:

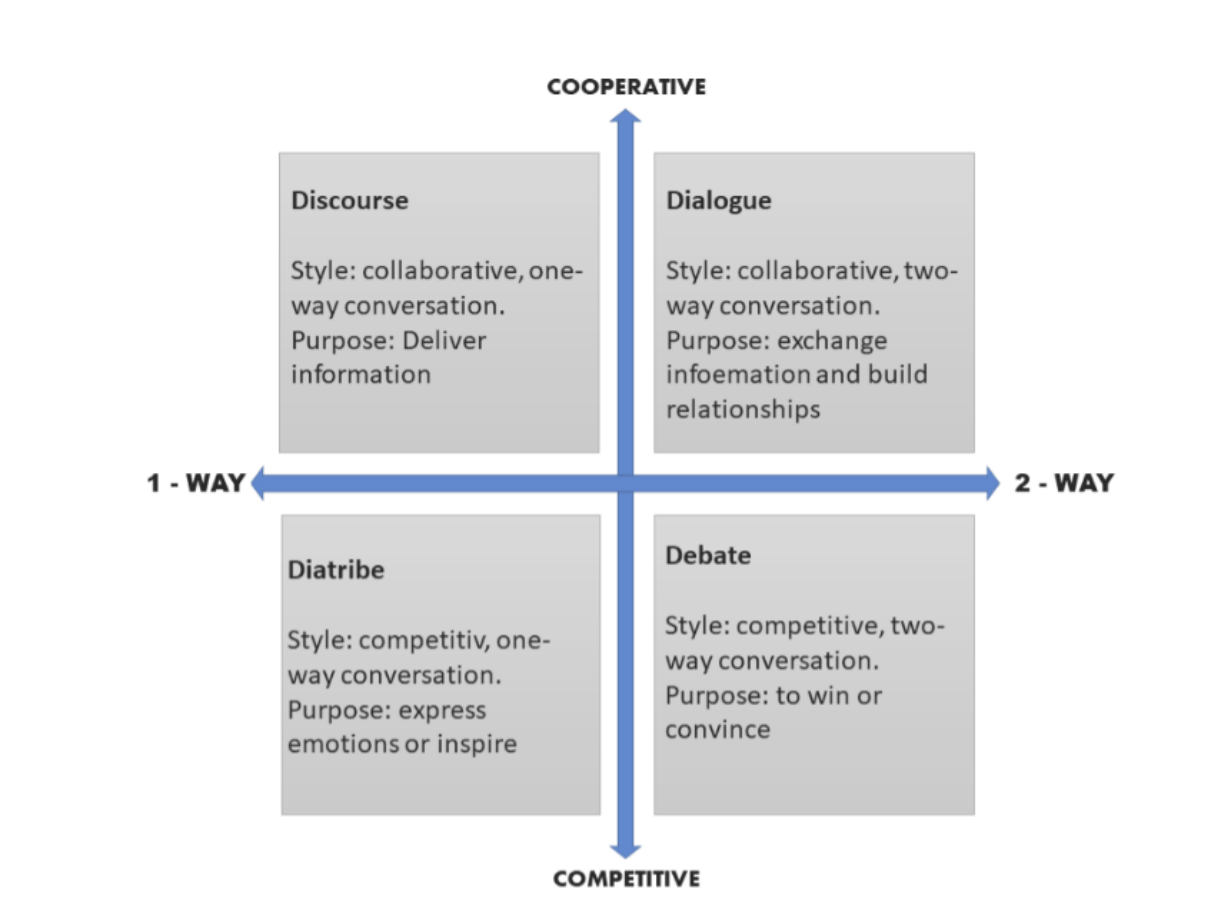
**Questions based on assumptions.** The assumption questions systematically influence the veracity of responses.

- Negative assumption questions suggest that there is a problem.
- Positive assumption question presupposes that there is no problem. What do you think about my beautiful dress? Here is assumed that my dress is beautiful. Positive assumption question: - based on tagging: include a phrase to prompt respondents to answer and most often include negative elements such as “Don’t you” – You enjoyed the movie, didn’t you?
- General assumption questions give a lot of information about totally irrelevant, general stuff, they're not learning about this problem.



# 3. COMMUNICATION

## 3.8. Types of Conversation 1



Source: <https://peepstrategy.com/four-types-of-conversation/>

### 3.9. Types of Conversation 2

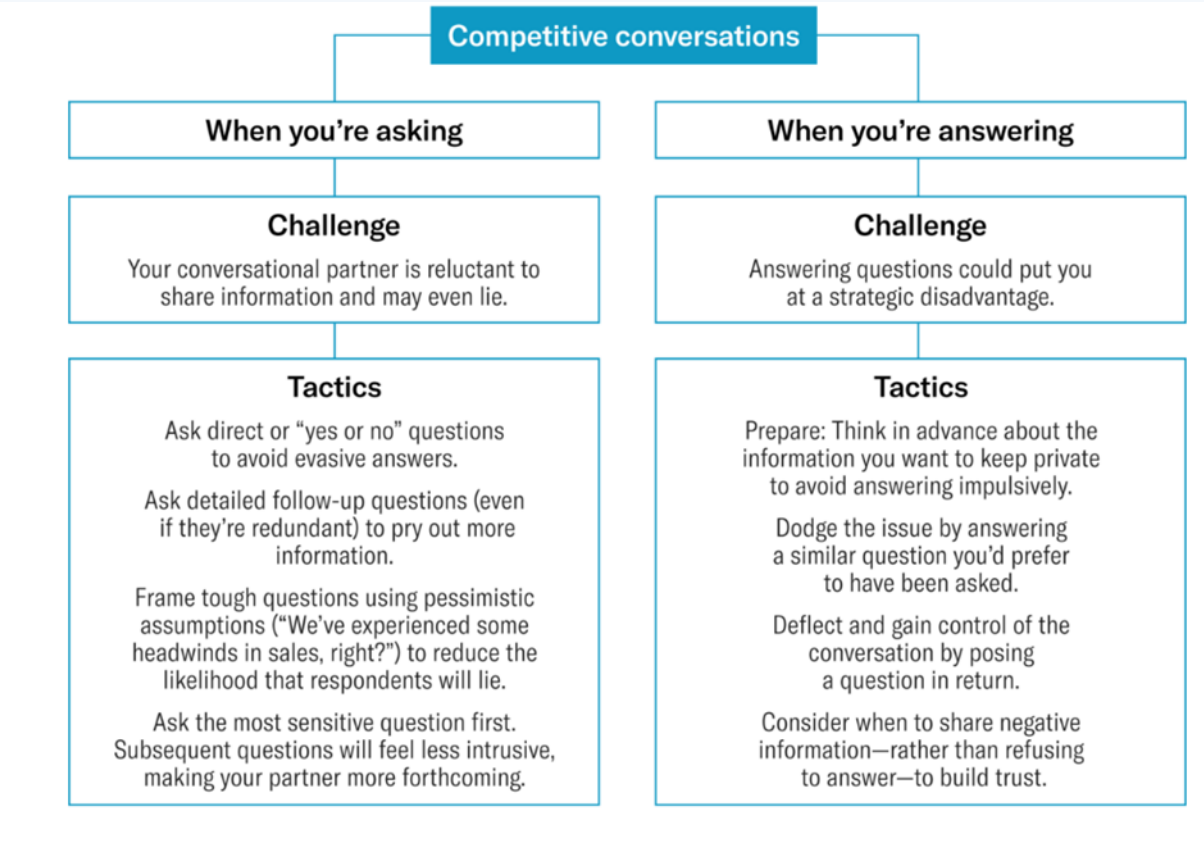
Based on direction and tone, there are four types of conversation: debate, dialogue, discourse, and diatribe.

- **Debate** is a competitive, two-way conversation with the goal to win or persuade.
- **Dialogue** is a cooperative, two-way conversation with the goal to exchange information and build relationships with one another.
- **Discourse** is a cooperative, one-way conversation with the goal to deliver information from the speaker/writer to the listeners/readers the speaker has an objective that may or not be shared by others who hear it.
- **Diatribe** is a competitive, one-way conversation with the goal to express emotions, browbeat those that disagree with you or inspires those that share the same perspective.

### 3. COMMUNICATION

#### 3.10. Types of Conversation 3

Depending on goal there are two types of conversations: **competitive and cooperative**.



Source: The Surprising Power of Questions Several approaches to develop mastery in the art of questioning.

### 3.11. Non-violent communication

With **Nonviolent Communication (NVC)**, from Marshal Rosenberg, we learn to hear our own needs and those of others.

It is important how you communicate about your needs, feelings, problems, and stress, and this communication impact how people connect with you.

**Violent communication** is communication that limits liberty, denies recognition of needs, diminishes the worth of a person, and/or blocks compassion.

To represent these two communication styles Marshall Rosenberg has chosen 2 animals:

- the wolf
- the giraffe.

Your Text Here

### 3.11. Non-violent communication

A **WOLF/JACKAL** is blocked in a way to focus on his core humanity and unable to build connections, is results-oriented, judgmental, critical and authoritarian.

A wolf:

- Gives moralistic judgements and evaluation – You are too lazy! You are always late.
- Avoid responsibility of his own feelings like blaming our feelings, thoughts, and actions on others – You make me feel bad! I wanted to focus on my work, but you always stop me from that!
- Pose demands – If you do not do that task, you will be fired.
- Block compassion – Why are you always late with your task. Do not worry, next time you may have more chances to get the promotion.



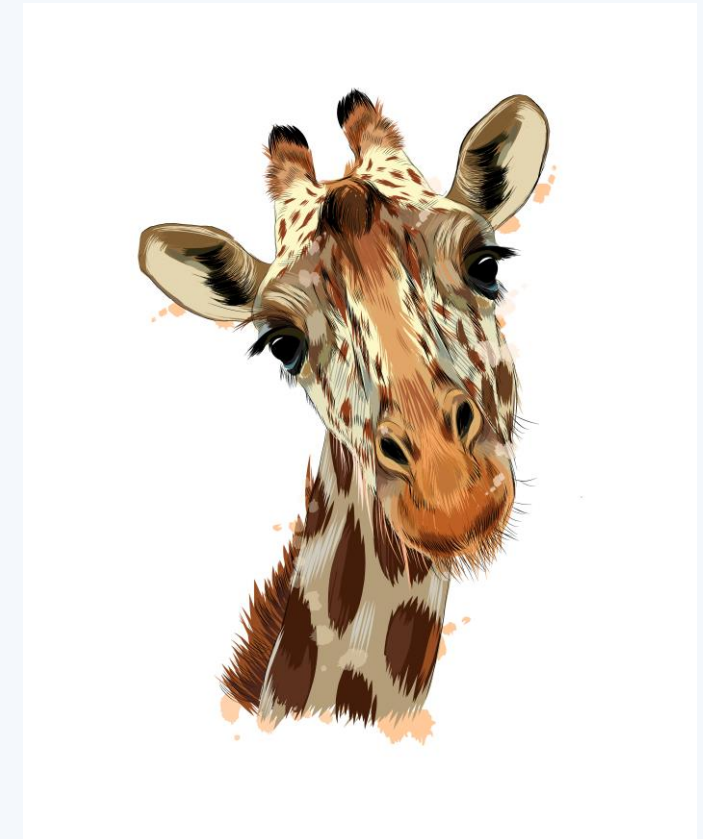
*Jackal. Source: [www.freepik.com](http://www.freepik.com)*

### 3.11. Non-violent communication

**The Giraffe** is strong and gentle/soft, kind, communicates from the heart and looks for connection and clarity, responds to situations with compassion.

A giraffe:

- Is very perceptive
- Expresses feeling
- Expresses needs
- Requests politely



*Giraffe. Source: Freepik.com*



### 3.11. Non-violent communication

#### Steps of NVC – the example of a giraffe

1. Observe the situation, only facts without introducing any judgment or evaluation
2. Then express your feelings connected with that situation. It is about your emotions. How do you feel, for example I am angry, disappointed or satisfied.
3. Express your needs, what you really need.
4. Make a request or a wish.

To listen with empathy to others, it is important to identify what is the need of the other person. Often, people feel the need to unleash their story, without the other surpassing their story with their own story, or a solution.

Example 1: your employee is late again for work. You really need his/her input and can't carry on without it. By using the 4 steps of non-violent communication, your message could sound like this: "I have noticed that I've been waiting for half an hour the last 3 times, and I find it difficult to carry on with my own work without your input. It really frustrates me because I find it very important to respect agreements made. Would it be possible in the future to tell me in advance that you will be late?"

### 3.11. Non-violent communication

#### Steps of NVC – the example of a giraffe

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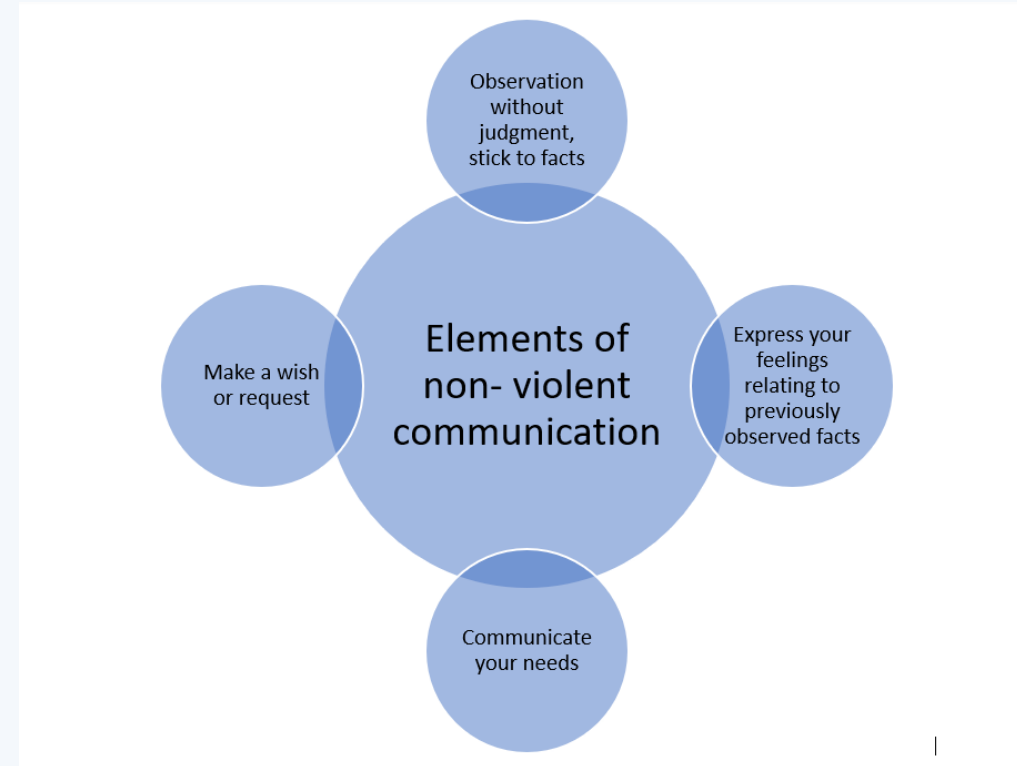
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### 3.11. Non-violent communication

#### Steps of NVC – the example of a giraffe

##### Example 2:

When you failed to do your homework again, I felt disappointed because I needed reassurance. How would it be for you if you fulfilled your promise next time?



*NVC model Source: Marshall Rosenberg Nonviolent Communication: A language of Life (20015)*

## 4. CONCLUSIONS

**Brainstorming** is a method of generating ideas and sharing knowledge to solve clearly defined design problems. It is a perfect tool for idea generation in controlled conditions and a free-thinking environment.

**Communication** is related to the process of understanding and sharing meaning (Pearson and Nelson, 2000), it is the act of transferring information from one place, person, or group to another. Every communication involves (at least) one sender, a message, and a recipient. Good communication means that when an interlocutor sends a message it is received without any distortion in meaning.

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# Fostering diGitalisation and blonic transformation of SMEs through the development of a novel and innovative Training material for overcoming COVID-19 crisis

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**Thank  
you**

Your Text Here

# TU. 2

# LU. 9

**TRAINING UNIT 2 – SOFT SKILLS FOR BIONIC TRANSFORMATION**

**LEARNING UNIT 9 – DESIGN & STRATEGIC THINKING**

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Source: Freepik

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# 1. INTRODUCTION

- Entrepreneurs use opportunities, overcome setbacks, learn from mistakes, quickly adapt and succeed in a variety of settings.
- Design thinking, strategic thinking and digitalization for entrepreneurs enable creativeness and innovation.
- Design thinking, strategic thinking and digitalization for entrepreneurs encourage critical thinking and problem solving.



*Communication. Source: Freepik*

## 2. INTRODUCTION TO DESIGN THINKING

### 2.1. DEFINITION

- A process that seeks to solve complex problems in a user-centric way,
- Turn ideas into tangible and testable products in the shortest possible time period.
- Handle problems of high complexity that cannot be solved using standard methods.
- Focuses on achieving solutions that are:
  - Technical feasible (they can be developed into functional products or processes).
  - Economically viable (affordable to businesses).
  - Desirable to the user (meeting a real human need).

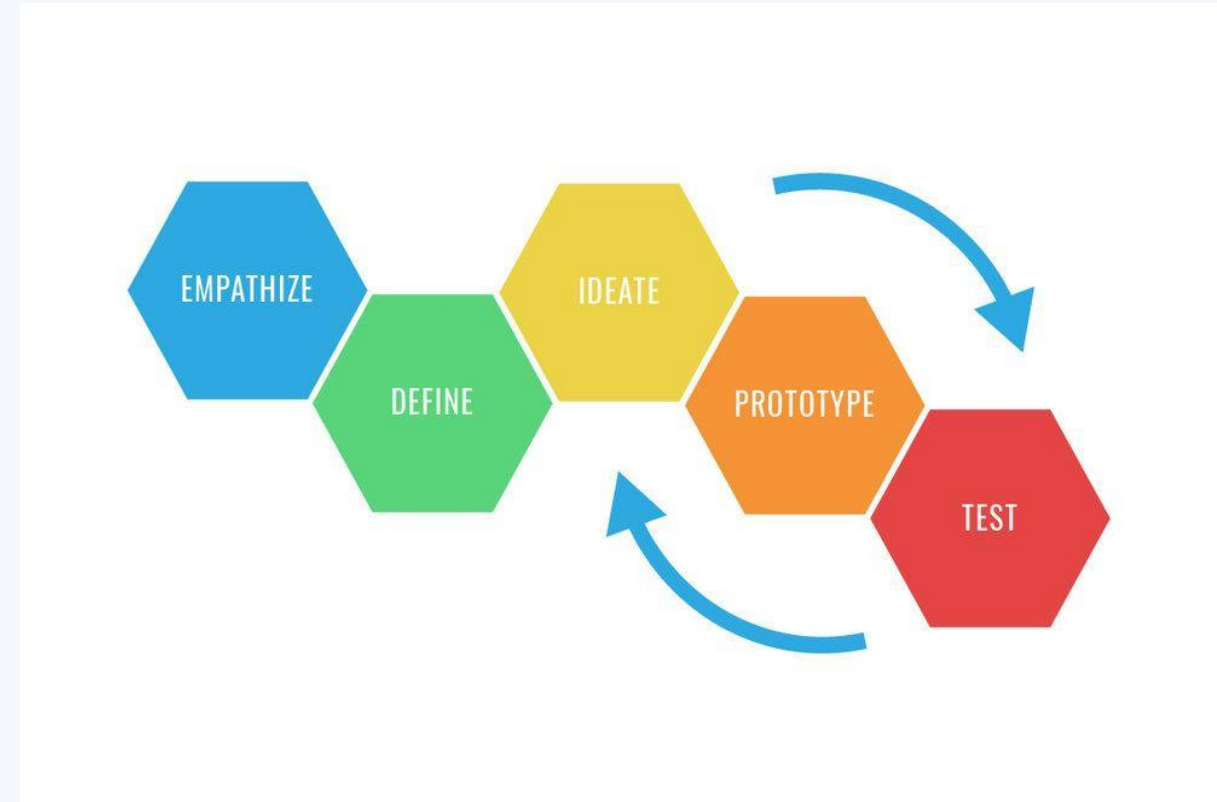


### 2.2. KEY PRINCIPLES

- User-centricity and empathy:** Aim is to find solutions that respond to real human needs. Essential part of the process is to experience product as target audience.
- Collaboration:** By pooling diverse perspectives and ideas from heterogeneous, multidisciplinary teams innovation is created.
- Ideation:** Encouraging participants to produce and share as many ideas and potential solutions as possible in a judgement-free zone with focus on quantity rather than quality.
- Experimentation:** Turning ideas into prototypes, testing them and making changes usually based on user-feedback.
- A bias towards action:** Design thinking favours action over discussion. Tangible prototypes tested in real-world context are used more than discussing potential solutions and making assumptions.

### 2.3. MAIN STEPS

- Explore
- Emphasize
- Define a strategic purpose
- Ideate
- Prototype, test
- Evaluate
- Implement



*Design Thinking steps. Source: [https://toppng.com/design-thinking-process-PNG-free-PNG-Images\\_213165](https://toppng.com/design-thinking-process-PNG-free-PNG-Images_213165)*

### 2.3. MAIN STEPS

#### Emphasize

- Understand and gather target group's needs by consulting and observing users,
- Through emphasizing phase of design thinking a team is able to gain insight in users' experiences, motivations and problems,
- Emphasizing helps defining the problem.

#### Define

- A clear problem statement to set out the specific challenge that will be addressed,
- Gives a fixed goal that will guide the entire design process while keeping the user satisfaction in mind,
- High quality problem statement is human-centered, wide enough for creativity, but specific to a degree to provide guidance and clear direction.

### 2.3. MAIN STEPS

#### Ideate

- Producing as many ideas and solutions as possible with a problem statement in mind,
- Creatively and innovatively by focusing on quantity rather than quality to encourage expressing of ideas,
- Use of techniques like brainstorming and reverse thinking and idea to gather ideas and thoughts.

#### Prototype

- A few selected ideas are turned into prototypes or scaled-down versions of a product or concept that needs to be tested,
- Tangible product that can be tested on real users in real world environment,
- It can be tested and measured.

#### Testing

- Show in which areas the prototype works well and where is the room for improvement,
- Based on results and feedback, changes can be made to the product before further investments.

## 3. INTRODUCTION TO STRATEGIC THINKING

### 3.1. DEFINITION

- A skill to envision or develop a solution
- The mental or thought process that an individual applies in the context of achieving a goal or a set of goals,
- Based on past experiences, current information and expectations about the foreseeable future,
- Pragmatic type of critical thinking with the focus on finding and developing unique opportunities to create new goals through dialogue,
- Actions to think ahead and feel winds of change,
- Competences to improve business strategies and create clarity out of complex and seemingly disconnected details.



*Neuro network. Source: Freepik*

### 3. INTRODUCTION TO STRATEGIC THINKING

#### 3.2. MAIN CHARACTERISTICS

- Readiness to think ahead and foresee potential challenges.
- Start asking questions to find right solutions.
- Flexibility in assessing new information, ideas and assumptions.
- Multiple time perspectives in analyzing problems (past, current and future perspectives).



Strategic thinking characteristics. Source:  
<https://www.pngwing.com/es/free-png-dkbol>



## 3. INTRODUCTION TO STRATEGIC THINKING



### 3.3. STRATEGIC AND NON-STRATEGIC THINKING

#### STRATEGIC THINKING

- Broad view with zoom in.
- Abstract with powerful engagement of the imagination.
- Abstraction illustrated with concrete examples.
- Important, non-intuitive, framework breaking ideas.
- Embraces alternatives and uncertainties.
- Aims to achieve an over-arching goal.

#### NON-STRATEGIC THINKING

- Narrow view.
- Concrete with no engagement of the imagination.
- Concrete illustration only.
- Generally understood ideas that fit within a consensus framework.
- Embraces neither alternatives nor uncertainties.
- Focuses on supporting goals.

## 3. INTRODUCTION TO STRATEGIC THINKING

### 3.4. MAIN SKILLS

#### **Analytical skills:**

- Capability to analyze a variety of inputs—from financial statements and KPIs, to market conditions, emerging business trends, and internal resource allocations.
- This initial analysis is crucial to creating a strategy that aligns with the current reality facing your organization.

#### **Communication skills:**

- Ability to communicate complex ideas, collaborate with internal and external stakeholders, build consensus, and ensure everyone is aligned and working toward shared goals.

#### **Problem-solving skills:**

- Implementing a strategy that addresses the central challenge requires first to understand the problem and its potential solutions.

#### **Planning and management skills:**

- Strategy is not just about thinking of a solution—it involves implementation.
- Once data has been analyzed, the problem is understood, and a solution has been identified, management skills are crucial to bring everything together.

### 3.5. HOW TO START?

#### **Learn to predict:**

- Gather as much information as possible
- Track daily work routine and activities to find bottlenecks

#### **Use visualization:**

- Create mental maps
- Use the whole picture

#### **Develop the backup plans:**

- Predict possible circumstances and puzzles
- Develop plan B, plan C, etc.

#### **Use past experience:**

- Usually someone has faced the same task or problem before
- Mistakes are not mistakes, but experience

#### **Think outside the box:**

- Avoid automatic decisions and stereotypes
- Use all experience and knowledge

## 3. INTRODUCTION TO STRATEGIC THINKING

### 3.6. WHY IS STRATEGIC THINKING USEFUL?

- Brings new ideas and improves collaboration among stakeholders.
- Enables consensus on development priorities and enhances synergy between activities carried out by different participants in the process.
- Limits or helps in addressing antagonisms.
- Creates an atmosphere of positive expectations.
- Develops a sense of ownership of the change process.
- Focuses resources on key priorities (promotes strategic thinking).
- Ensures a basis from which progress can be measured.
- Brings together relevant actors and fosters consensus on where they all want to go together.
- Increases productivity through increased efficiency.
- Resolves key company issues.

## 3. INTRODUCTION TO STRATEGIC THINKING



### 3.7. MAIN BENEFITS

#### **Efficiency**

- Organizations are better aligned with customer needs (less wasted time and effort).

#### **Collaboration**

- Strategic thinking helps the entire team aim for a common goal.

#### **Better relationships**

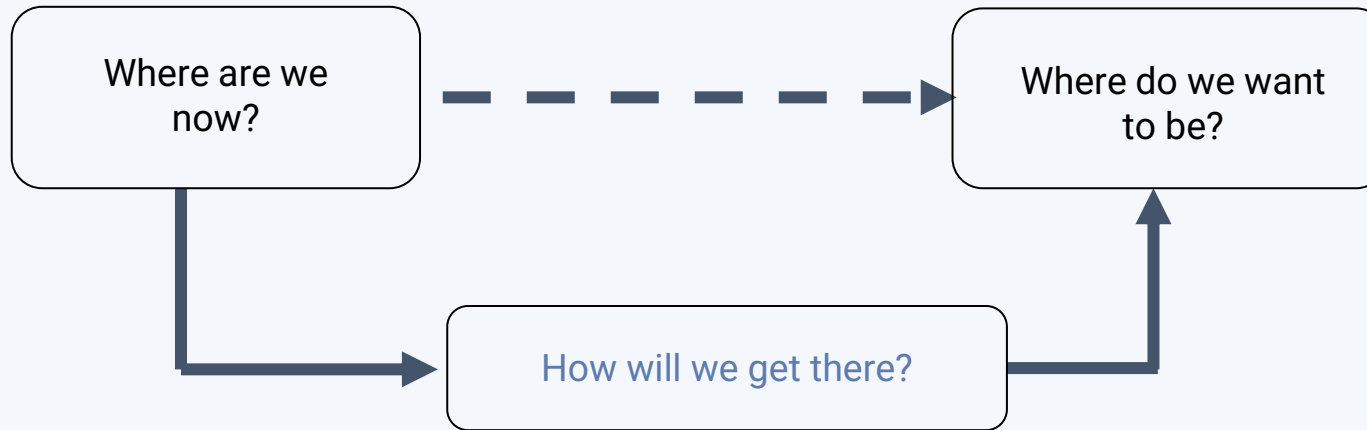
- Company and clients share the same mindset - cohesive nature.

#### **Longevity**

- Additional projects, recommendations, and lasting friendships with business leaders.

## 4. STRATEGIC PLANNING

Strategic planning is a process!



- Collaboration and access across departments, partners, vendors, product and people!
- Holistic approach to manufacturing, connecting the physical and digital!
- The focus is on the process that people need to go through, not on the product!
- The focus is on developing strategic thinking, not techniques!

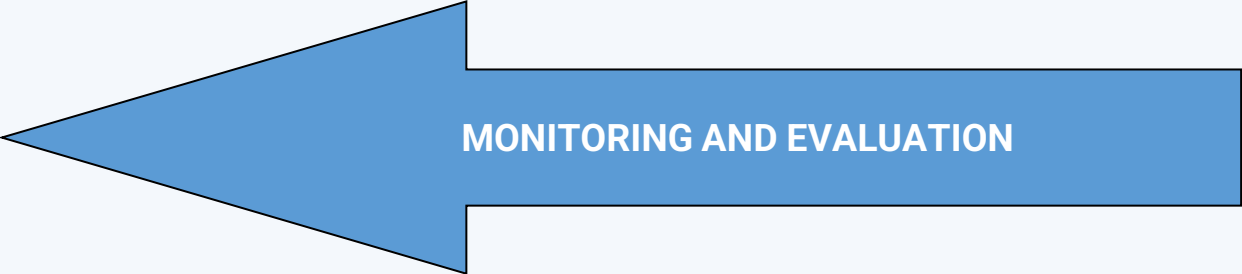


# 4. STRATEGIC PLANNING

## 4.1. BASIC STEPS



- |                   |                         |                          |
|-------------------|-------------------------|--------------------------|
| -Stakeholders     | -Vision/Mission/Values  | -Defining responsibility |
| -Basic Analysis   | -Objectives /Priorities | -Time frame              |
| -Problems / Needs | -Activities / projects  | -Management              |
| -SWOT/ TOWS       | -Sources of financing   | -Monitoring              |
| -PESTLE           |                         | -Update                  |



## 4. STRATEGIC PLANNING

### 4.2. SITUATIONAL ANALYSIS

- The objective of the basic analysis is not to describe the situation using as much data as possible.
- The objective of the analysis is to evaluate the resources of the company in relation to the desired changes towards the bionic enterprise.
- The quality of the analysis depends on the quality of the input data and the quality of the interpretation of the collected data.
- In the preparation of the analysis, it is assumed that such an analysis is not a purpose in itself, but a means of coming to the right questions to which strategic thinking should provide answers.
- The quality data included in the analysis must be strategically important and enable the description of the phenomenon
- The logic of making the analysis:



- Selection of indicators influenced critical testing capabilities

### 4.2. SITUATIONAL ANALYSIS

#### INTERNAL ASSESSMENT

##### 1. Organization Analysis

- Registration and activity (regular activity, significant projects in progress)
- Organization analysis (description) with organizational chart
- Levels and management systems

##### 2. Analysis of technical infrastructure

- Equipment
- Technology

##### 3. Analysis of the personnel structure

- Knowledge and skills for bionic transformation

##### 4. Analysis of financial reports

- Do we have the means to finance the bionic transformation process?
- Will the transformation lead to an increase in the company's revenue and a reduction in costs?

## 4. STRATEGIC PLANNING

### 4.2. SITUATIONAL ANALYSIS

#### EXTERNAL ASSESSMENT

##### 4 CRITICAL QUESTIONS

- What is the economic environment in which we must operate?
- What competencies does the organization have that provide a sustainable competitive advantage?
- What resources support or constrain our actions?
- What opportunities lay before us?

##### TECHNIQUES

- **Users personal** – summaries that represent stakeholders needs and priorities.
- **Infographics** - illustrative images that combine data, text and images in a cohesive design is a long-standing way of providing clear situation analysis .
- **Tables, graphs, statistics and interactive dashboards** - summary information presented in a structured and approachable format.
- **Additional examples of analysis** – exploration of macro environment and relevant sectoral analyses.

### 4.3. IDEAS FORMULATION – DESIRABLE FUTURE

- What will influence the future?
- What is a direction for future and response to these influences?
- How to describe the desired results in measurable terms?



Idea. Source: Freepik

### 4.4. PLANNING PHASE- HOW TO IDENTITY AND IMPLEMENT NEW IDEAS

#### MAIN QUESTIONS

- How many options there are to achieve planned goals?
- Are the options real and achievable in effective ways?
- What are the best ways and means to get there?
- How to measure progress and success?

#### TECHNIQUES

##### Agile Framework

- Direct response to traditional “waterfall” methods of planning and management
- Immediate adapting to environment and trends
- Ensuring greater targeting



### 4.5. AGILE WORKING METHODS FOR PLANNING DIGITAL FUTURE

#### Scrum

- Methodology for addressing complex problems that require regular adaptation, e.g., for knowledge transfer or the development and delivery of complex work.

#### Kanban

- Methodology to manage and prioritize workflow. It visualizes both the process (the workflow) and the actual work passing through that process. This working technique is suited to identifying potential bottlenecks and fix them quickly.

#### SAFe (Scaled Agile Framework)

- Methodology for structural reorganization in a large company to sustainably meet the objectives of agile working.

#### LeSS (Large-scale Scrum)

- Methodology for scaling beyond a complex systems with multiple possible solutions during the planning phase.

#### Interactive roadmaps

- Open information to empower the audience both to explore plans and provide feedback as part of the roadmap.

### 4.6. FROM STRATEGIC THINKING TO DIGITAL STRATEGIC PLANNING

- Strategic thinking is a prerequisite to digitalization strategy.
- Digitalization strategy is a detailed plan of dealing with the key challenges of convergence of the physical, digital and human worlds.
- Digitalization strategy identifies digital capabilities that are considered as potentials within a new sustainable business model.
- Digital readiness assessment - systematic and comparative analysis of a company's digital maturity.
- Digital transformation of companies is the application of digital technology in business, and it ensures the change of business culture.
- There is still a great deal of uncertainty associated with digitization.

## 5. DIGITALIZATION STRATEGIES

- The use of digital technologies to change an organization's operating model and provide new revenue or equivalent value-creating opportunities.
- The process of moving to a digital business/organization.
- A significant increase in efficiency, effectiveness and sustainability.
- Can lead to significant break-up of established value chain structures and business models.



*Digital business. Source: Freepik*

## 5. DIGITALIZATION STRATEGIES

### 5.1. KEY ELEMENTS

#### Capabilities:

- based on gathered information synthesis and blueprint capabilities
- test capabilities

#### Experience:

- investing in the experience by wrapping capabilities and solutions

#### Demand generation:

- strategy needs to include shifting demand to digital channels

#### Collaboration:

- assuring alignment and collaboration across business and technology teams
- method of engaging with third party vendors and partners, managing collaborations, using selected metrics to measure progress

#### Institutional mission, vision and values

- alignment at the organizational level
- where and why digital strategy is placed to complement the overall organizational strategy

#### Co-creation

- fresh insights reflected by innovations brought to the market
- validation of internally developed ideas
- good public relations and communication content

## 5. DIGITALIZATION STRATEGIES

### 5.2. CO-CREATION AS A KEY SUCCESS FACTOR IN STRATEGIC PLANNING PROCESS

- Creating a clear and measurable objective that will determine recruiting targets and methodology - creating a new product or service or improving an existing product or service.
- Experienced partner for co-creation of a project that can provide guidance through the process and that is able to define a plan that can be fine-tuned through collaborative effort.
- Co-creation is not a methodology and can be involved through a variety of methods that should all be considered.
- Engaging consumers makes them feel valued and it will affect the quality of outcome.
- Keeping an open mind and encouraging freedom to fully express.



*Strategy. Source: Freepik*

### 5.3. DEFINING A VISION

- A key part of strategy development and strategic orientation is to articulate a VISION for the desired state in the future.
- VISION is a concise statement that describes what we want to achieve in ideal conditions.
- The vision provides direction and inspiration for shaping goals and points to the meaning of the future direction in development.

### 5.4. WHAT IS A STRATEGIC GOAL?

Strategic goal answers the question of **WHAT we want to achieve?**

- Statement of the general result that the document / institution intends to achieve in terms of specific needs, conditions or possibilities
- Demonstrates that results are expected in the long term
- General (*less specific*) than other types of goals
- Strategic goal is the objective of the highest level
- It represents a clear direction of movement in the long term (five or ten years)
- It indicates the main directions of achieving the vision and the end results intended to be achieved by the end of the planned period
- A significant number of strategic goals - not too many, but to cover all aspects of development – should preferably be at least three and at the most six
- The achievement of strategic goals directly contributes to the realization of the vision



### 5.5. SOME CHARACTERISTIC OF STRATEGIC GOAL

- Once the strategic goals are set, they should not be changed.
- Strategic goals imply consensus.
- Horizontal alignment of objectives (cross-sectoral / cross-departmental).
- Vertical alignment of objectives (coherence of lower and higher rank objectives).



*Strategic goal. Source: Freepik*

## 5. DIGITALIZATION STRATEGIES

### 5.6. PRINCIPLES FOR THE FORMULATION OF STRATEGIC GOAL

#### **Relevance**

- goals should correspond to the institution's mission and/or sector vision, based on analysis

#### **Realistic approach**

- realistic goals in relation to external and internal factors

#### **Motivation/commitment**

- goals must stimulate activities in the institution and determine obligations in advance

#### **Transparency/comprehensibility**

- simple and understandable

#### **Compliance**

- objectives in different strategic documents must not be contradictory

### 5.7. EXAMPLES OF DIGITAL STRATEGY

#### The University of Edinburgh

##### Vision:

Digital transformation at the University is about more than just technology. Our goal is to adopt new ways of working in order to continue delivering our mission in the face of changing technology, competition, audience needs and behaviour.

##### Main programs:

- User-Centered Portal and Notifications
- Dana Warehouse Enterprise
- User Experience Services
- Document Management
- Integrated Identities



### 5.8. ACTION PLAN- IMPLEMENT DOCUMENT

The action plan is the basis for systematic control and supervision of implementation. It is audited on an annual basis, and it develops a management tool. The Action Plan consists of:

- Anticipated activities,
- The period of implementation of the plan and individual activities,
- Executors of activities,
- The interconnection of activities,
- Prioritization of activities,
- **The costs of implementing certain activities,**
- **sources of financing of activities,**
- Ways and indicators to monitor the realization of the plan,
- Control of the implementation of the plan.

### 5.9. ACTION PLAN- HOW TO MEASURE ITS IMPLEMENTATION?

#### **Outcome**

- Number of complaints received

#### **Outputs**

- Number of views and downloads
- Number and types of error(s)
- Ratio of views compared to downloads

#### **Means**

- User Acceptance Testing (UAT) results

#### **Inputs**

- Employees and customers surveys and inclusive governing groups

**Company approval specific KPIs (key performance indicators)**

## 6. CONCLUSIONS

- **Design thinking** is a creative process towards innovative solutions
- **Strategic thinking** is a skill to envision or develop a solution
- **Strategic planning** is a process to create and achieve a vision
- **Digitalization** as a new reality for business sector seeks for design thinking, strategic thinking and strategic planning for transformation in bionic companies

- Keelin & Arnold, 2002, 'Five Habits of Highly Strategic Thinkers'
- <https://www.linkedin.com/pulse/six-elements-good-digital-strategy-bob-barr>
- <https://www.invisionapp.com/inside-design/what-is-design-thinking/>
- <https://www.effectivegovernance.com.au/page/knowledge-centre/news-articles/what-is-strategic-thinking>
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- <https://www.fostec.com/en/competences/digitalisation-strategy/>
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- <https://www.archimag.com/demat-cloud/2021/06/23/ged-ia-data-supplement-digitalisation-dematerialisation-processus>
- <https://disbug.io/en/blog/customer-feedback>
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# Fostering diGitalisation and bionic transformation of SMEs through the development of a novel and innovative Training material for overcoming COVID-19 crisis

[HTTPS://GIST-PROJECT.EU/](https://gist-project.eu/)



**Thank  
you**

Your Text Here

# TU.2

# LU.10

**TRAINING UNIT 2 – SOFT SKILLS FOR BIONIC TRANSFORMATION**

**LEARNING UNIT 10- COLLABORATION & DECISION MAKING**

Your Text Here



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1. Introduction to collaboration and decision-making
2. Collaboration
  - 2.1. What is collaboration?
  - 2.2. Types of collaboration
  - 2.3. Benefits of collaboration
  - 2.4. Collaboration software
  - 2.5. Team building
  - 2.6. Tuckman's model
  - 2.7. Relationships

3. Decision-making
  - 3.1. Introduction
  - 3.2. What is critical thinking?
  - 3.3. What is thinking?
  - 3.4. A model for critical thinking by Richard Pau
  - 3.5. Group decision-making
  - 3.6. Gradient of agreement
  - 3.7. Obstacles to decisión-making
  - 3.8. Hats method
4. Conclusions



Teamwork. Source: Gerd Altmann Pixabay

# 1. INTRODUCTION TO COLLABORATION AND DECISION-MAKING



In this module, you will become familiar with collaboration and decision-making process. You will explore different types of collaboration and collaboration software especially in the post pandemic times, technologies that can boost the collaboration and collaboration benefits. You will gain the ability to identify most appropriate models of collaboration. You will learn how to design and lead teams and collaborations to achieve success using the Tuckman's model.

By the end of this module, you will be also able to distinguish different types of decision making, to choose and apply appropriate problem solving and decision-making processes and methods and identify common obstacles to effective decision making. We deal with the challenge of how to ask questions and improve your reasoning skills. Upon completing this module, you will be able Identify common obstacles to effective problem solving and decision making and to implement the six Hats method based on the brain's different modes of thinking.



## 2. COLLABORATION

### 2.1. WHAT IS COLLABORATION?

Collaboration is the process of two or more people or organizations working together to complete a task or achieve a goal or to achieve shared goals.

“Coming together is a beginning. Keeping together is progress.

Working together is success.”

– Henry Ford

“It is the long history of humankind (and animal kind, too) that those who learned to collaborate and improvise most effectively have prevailed.” – Charles Darwin



*Collaboration. Source: Tumisu Pixabay*



## 2. COLLABORATION



### 2.2. TYPES OF COLLABORATION

- **Team collaboration** – where people know each others and share a common goal
- **Contextual collaboration** – relates to digital teams where people have the access to all files, software gathered in one digital workplace platform, and they do need to switch between tools or apps when they need to collaborate. This puts work in context.
- **Cross-functional collaboration** - when teams from various departments or verticals come together to accomplish a common goal for the entire organization.
- **Community collaboration** – it is about learning and sharing knowledge within teams as opposed to carrying out tasks or completing work in team collaboration when senior members of a team can share knowledge, they have accumulated with individual team members or a group and the information they hold is easily accessible.
- **Social collaboration** - When team members can reach any other team member or a group of team members on a real-time basis on a platform designed to accommodate such features.
- **Cloud collaboration** - teams can upload, access, work on and deliver their work entirely on a cloud based digital workplace platform.
- **Virtual collaboration** – for virtual meetings, a digital workplace platform that can bring companies all the benefits of virtual meetings and the convenience of a platform that also allows to access work resources within it.

## 2. COLLABORATION

### 2.2. TYPES OF COLLABORATION

We can distinguish different types of collaboration:

- **Face-to-face collaboration**

- **Remote collaboration**- using online tools and collaborating in the same time or emailing in different time. This type of collaboration requires software.

Collaboration can be also **synchronous, versus asynchronous** - answering emails. Some tasks, projects requires certain types of collaboration.

**“No one can whistle a symphony. It takes a whole orchestra to play it.” H.E. Luccock**



*Orchestra. Source: Tatyana Kazakova Pixabay*

## 2. COLLABORATION

### 2.3. BENEFITS OF COLLABORATION

- increase organizational and group transparency
- amplify the flow of knowledge throughout the organization
- boost team and organizational productivity
- waste less employee time
- be a healthier and more profitable organization
- identify organizational blind spots and vulnerabilities
- retain customers
- build trust among employees
- retain employees
- communicate better



*Collaboration. Source: Gerd Altmann Pixabay*

## 2. COLLABORATION



### 2.4. COLLABORATION SOFTWARE

In the era of Covid 19 and post-pandemic the increase of the collaboration tools was enormous. They have a modern design and are easy to use. They serve as a source of information and knowledge. People using the collaboration hubs spend less time looking for documents. They are not a project management tool, but they can support it.

What are the **most popular collaboration tools**:

- Zoom
- Microsoft TEAMS
- Facebook
- Google workspace

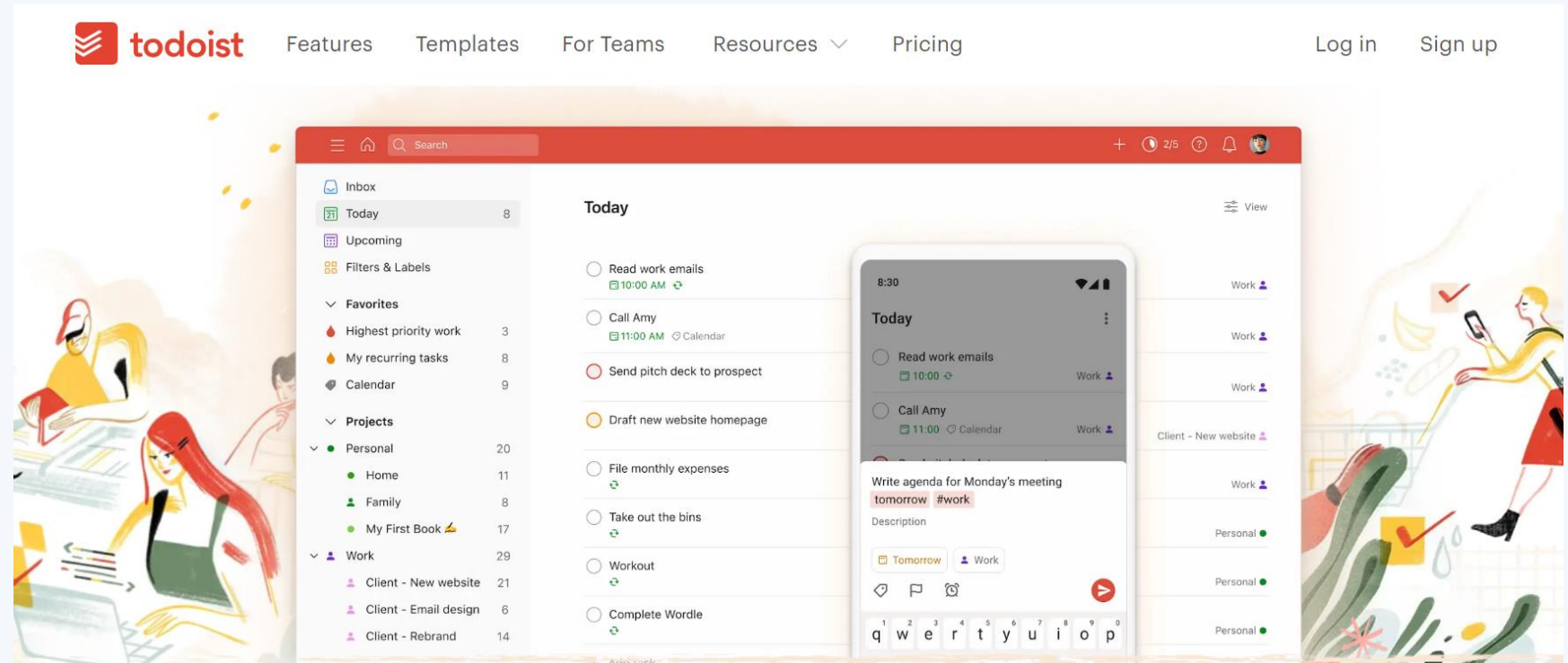
They are not used separately; they can be combined with a variety of applications.

## 2. COLLABORATION

### 2.4. COLLABORATION SOFTWARE

Tools for the purpose of **completing tasks**:

- TODOIST,
- GOOGLE TASKS,
- FREEDOM,
- TOGGL



*Todoist. Source: [www.todoist.com](http://www.todoist.com)*



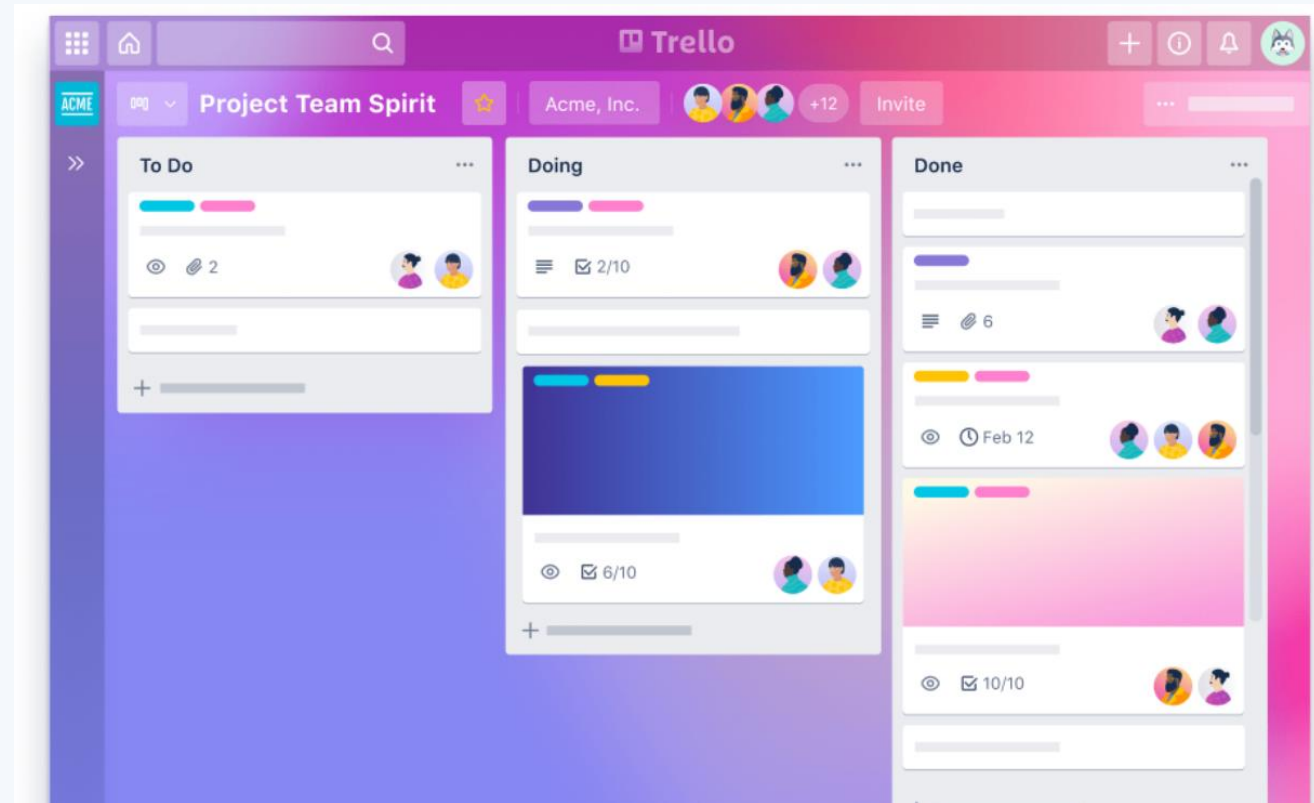
## 2. COLLABORATION

### 2.4. COLLABORATION SOFTWARE

#### Project management tools:

- Trello,
- Basecamp,
- Smartsheet,
- Asana,
- Wrike

**Trello** is a collaboration tool that organizes projects into boards. It deliver the information on what's being worked on, who's working on what, and where something is in a process. Trello is place to comment and collaborate with your team and it is accessible from any computer and smartphone.



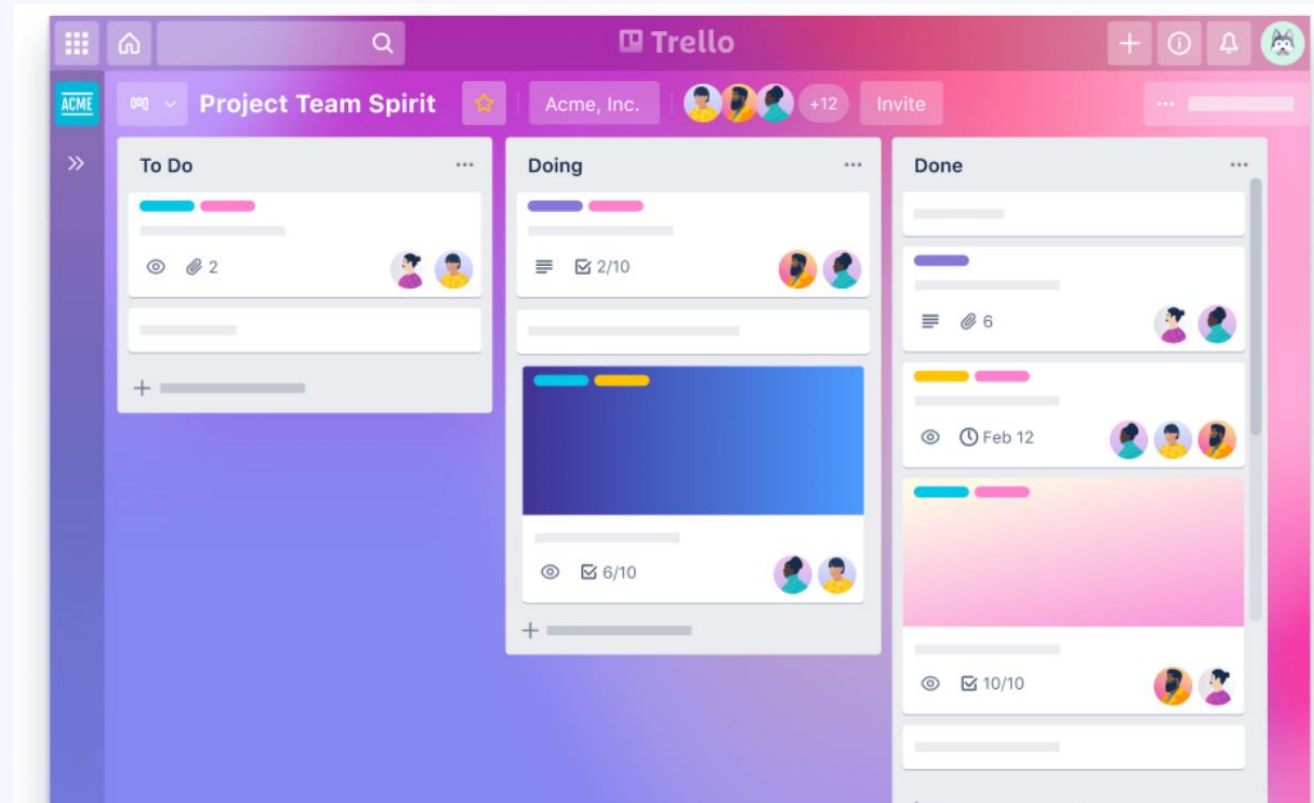
Trello. Source: [www.Trello.com](http://www.Trello.com)

## 2. COLLABORATION

### 2.4. COLLABORATION SOFTWARE

#### Project management tools:

**Trello** is a collaboration tool that organizes projects into boards. It deliver the information on what's being worked on, who's working on what, and where something is in a process. Trello is place to comment and collaborate with your team and it is accessible from any computer and smartphone.



Trello. Source: [www.Trello.com](http://www.Trello.com)

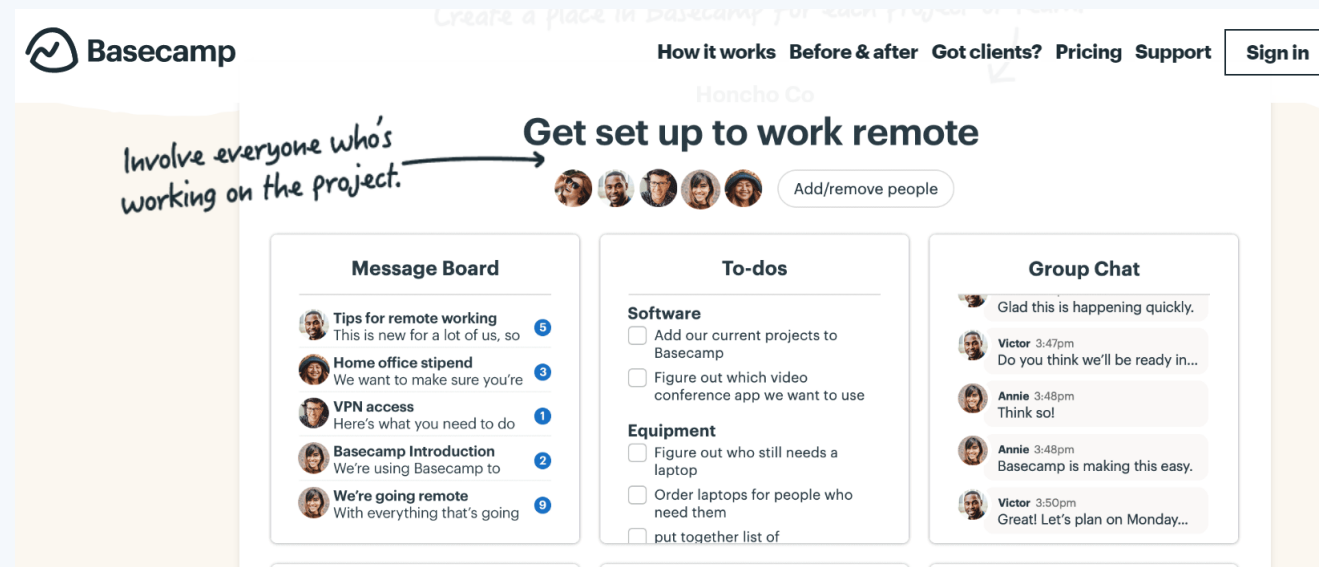


## 2. COLLABORATION

### 2.4. COLLABORATION SOFTWARE

#### Project management tools:

**Basecamp** is another collaboration tool, project management tool that arrange your teamwork. It is a tool that gives everybody to see where they are, where are the others and know exactly where to put the next thing everyone needs to know about. You can access Basecamp from the web, on iOS, and Android.



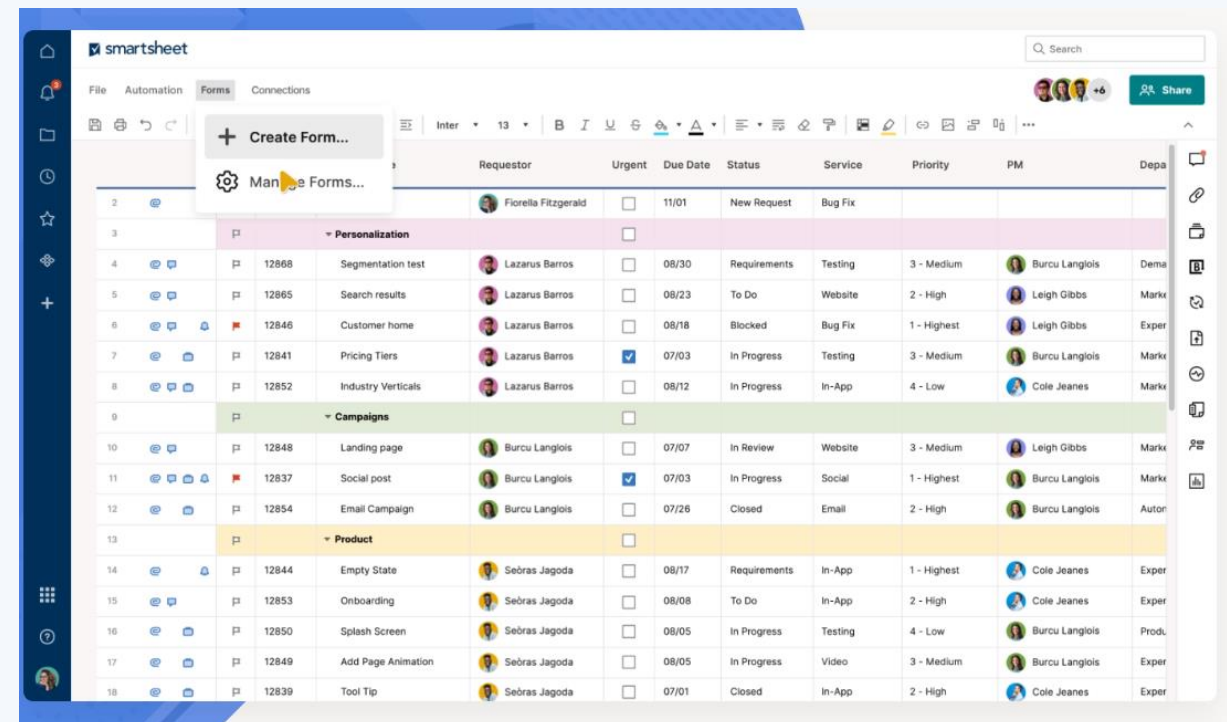
Basecamp. Source: [www.basecamp.com](http://www.basecamp.com)

## 2. COLLABORATION

### 2.4. COLLABORATION SOFTWARE

#### Project management tools:

**Smartsheet** is a work management tool that offers a rich set of views, workflows, reports, and dashboards to capture and track your plans, resources, and schedules. Smartsheet integrates with software you're already using.



|    | Requestor           | Urgent                              | Due Date | Status       | Service | Priority    | PM             | Depa  |
|----|---------------------|-------------------------------------|----------|--------------|---------|-------------|----------------|-------|
| 2  | Fiorella Fitzgerald | <input type="checkbox"/>            | 11/01    | New Request  | Bug Fix |             |                |       |
| 3  | Personalization     |                                     |          |              |         |             |                |       |
| 4  | Lazarus Barros      | <input type="checkbox"/>            | 08/30    | Requirements | Testing | 3 - Medium  | Burcu Langlois | Dema  |
| 5  | Lazarus Barros      | <input type="checkbox"/>            | 08/23    | To Do        | Website | 2 - High    | Leigh Gibbs    | Mark  |
| 6  | Lazarus Barros      | <input type="checkbox"/>            | 08/18    | Blocked      | Bug Fix | 1 - Highest | Leigh Gibbs    | Exper |
| 7  | Lazarus Barros      | <input checked="" type="checkbox"/> | 07/03    | In Progress  | Testing | 3 - Medium  | Burcu Langlois | Mark  |
| 8  | Lazarus Barros      | <input type="checkbox"/>            | 08/12    | In Progress  | In-App  | 4 - Low     | Cole Jeanes    | Mark  |
| 9  | Campaigns           |                                     |          |              |         |             |                |       |
| 10 | Burcu Langlois      | <input type="checkbox"/>            | 07/07    | In Review    | Website | 3 - Medium  | Leigh Gibbs    | Mark  |
| 11 | Burcu Langlois      | <input checked="" type="checkbox"/> | 07/03    | In Progress  | Social  | 1 - Highest | Burcu Langlois | Mark  |
| 12 | Burcu Langlois      | <input type="checkbox"/>            | 07/26    | Closed       | Email   | 2 - High    | Burcu Langlois | Auton |
| 13 | Product             |                                     |          |              |         |             |                |       |
| 14 | Seöras Jagoda       | <input type="checkbox"/>            | 08/17    | Requirements | In-App  | 1 - Highest | Cole Jeanes    | Exper |
| 15 | Seöras Jagoda       | <input type="checkbox"/>            | 08/08    | To Do        | In-App  | 2 - High    | Cole Jeanes    | Exper |
| 16 | Seöras Jagoda       | <input type="checkbox"/>            | 08/05    | In Progress  | Testing | 4 - Low     | Burcu Langlois | Produ |
| 17 | Seöras Jagoda       | <input type="checkbox"/>            | 08/05    | In Progress  | Video   | 3 - Medium  | Burcu Langlois | Exper |
| 18 | Seöras Jagoda       | <input type="checkbox"/>            | 07/01    | Closed       | In-App  | 2 - High    | Cole Jeanes    | Exper |

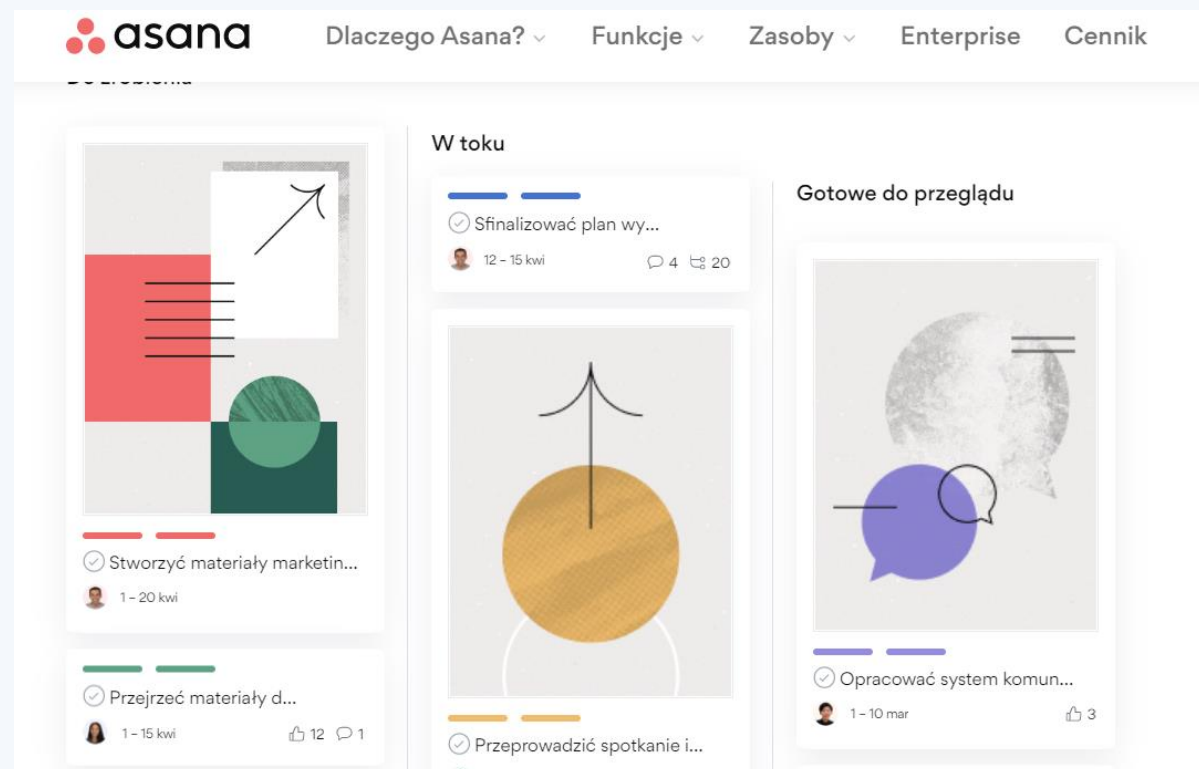
Smartsheet. Source: [www.smartsheet.com](http://www.smartsheet.com)

## 2. COLLABORATION

### 2.4. COLLABORATION SOFTWARE

#### Project management tools:

**Asana** is a team management tool and project management tool that organize a work in a way that everybody know what is doing, what has to be done and who is responsible for what. Asana is compatible with many other applications.



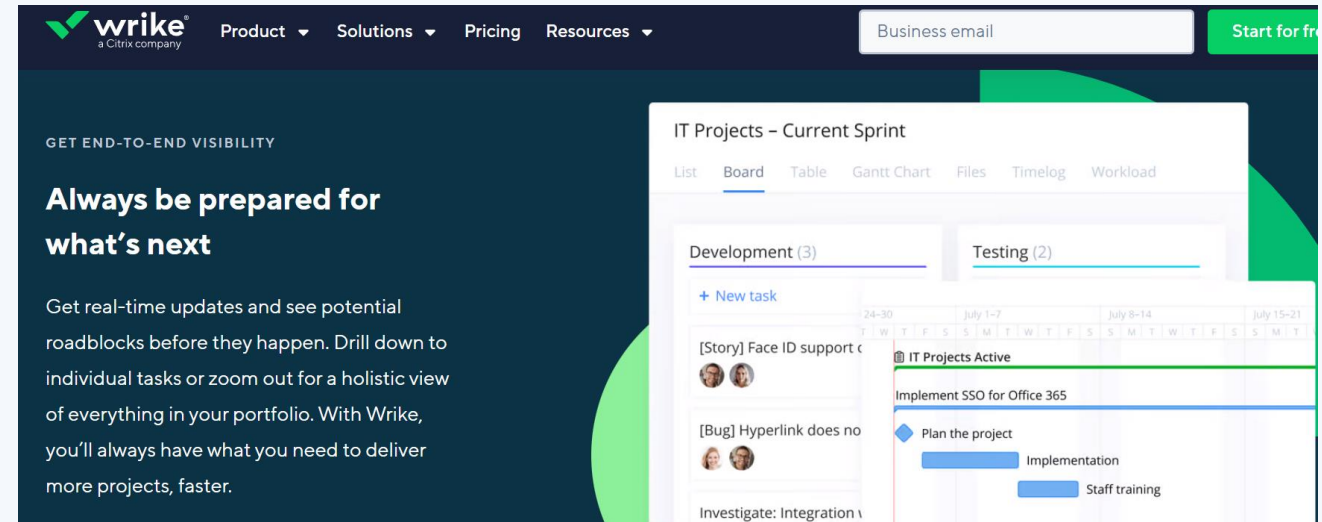
Asana. Source: [www.asana.com](http://www.asana.com)

## 2. COLLABORATION

### 2.4. COLLABORATION SOFTWARE

#### Project management tools:

**Wrike** is a work management software that has custom dashboards and workflows, team-specific automation to streamline processes. Wrike eliminates endless email threads, too many meetings, and provide real-time commenting and notifications, live editing, dynamic reports, and more. All information are shared with all at any time



Wrike. Source: [www.wrike.com](http://www.wrike.com)

## 2. COLLABORATION

### 2.5. TEAM BUILDING

A team is an interdependent group of people working towards a shared goal. It means that members need each other to reach the goal and they are not able to reach it individually. Team are everywhere, at schools, business, family, sport.



*Team. Source: Alexas Fotos Pixabay*

### 2.5. TEAM BUILDING

According to the research conducted by Frank LaFasto and Carl Larson (2001) the success of the team depends on:

1. Members who should be experienced in the team field of activity, open minded with the willingness to deal with problems, they should be eager to make an environment where people can say what they think. Team members should possess also a problem-solving ability, should be action oriented and have a good, positive personality.
2. Team relationship that should be productive and should allow providing and accepting the constructive feedback.
3. Team problem solving. Effective teams are very focused at each moment of work and sure of their goals, they have a positive approach and climate and open communication environment.
4. Team leader is fundamental to the success of the team and should be goal oriented, reliable, should build an environment of confidence. Team leader should also be able to build and maintain the climate of cooperation, should possess the adequate knowledge and skills and manage the work of the team and set priorities to finally reach the goal.
5. The organizational environment that should involve the proper management, system, structure and processes.

### 2.5. TEAM BUILDING

Carl Larson and Frank Lafasto's Typology of Teams to distinguish three types of work that teams do:

- Tactical,
- Problem solving,
- Creative.

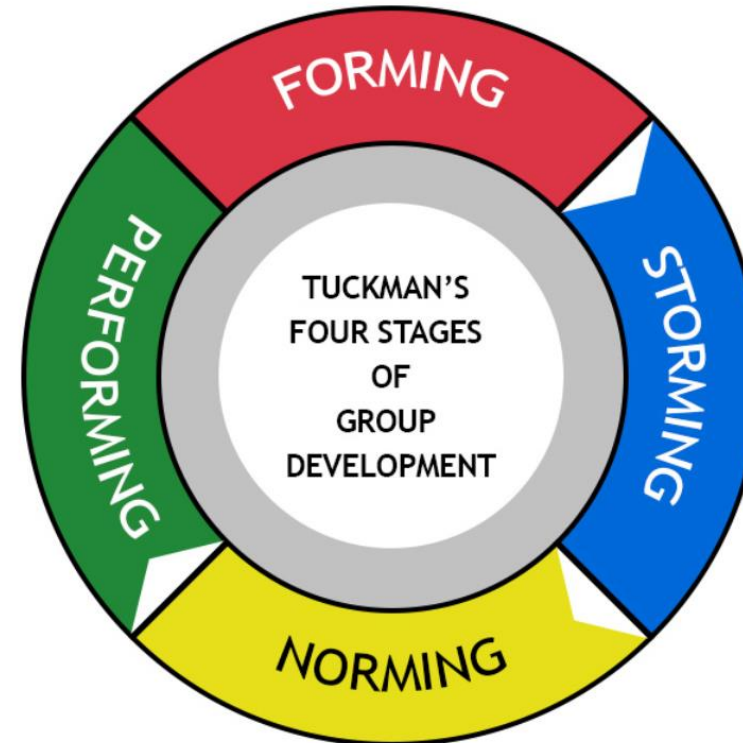
Types of teams:

- Traditional - physically close and spend much time together.
- Hybrid – are combination of virtual and traditional, some members can be virtual, on the other end of the world.
- Virtual teams - are never in the same place at the same time, rely on technology to communicate, they must deal with time zones.



### 2.6. TUCKMAN'S MODEL OF TEAM DEVELOPMENT

According to Tuckman, we can distinguish five stages of group development, and all are necessary and inevitable to make team to grow, face up to challenges, tackle problems, find solutions, plan work, and deliver results.



*Tuckman's model. Source: <https://www.funktionevents.co.uk/team-building/blog/tuckman-theory>*

### 2.6. TUCKMAN'S MODEL OF TEAM DEVELOPMENT

- **Forming** – it is the beginning of the group development when participants are unsure about the aim of the group, and they are looking for directions from the leader. The forming stage is about establishing the objectives of the group and getting to know each other. Participants can define their personal goals connected with the team.
- **Storming** – it is a conflict stage when people are pushing against boundaries, participants may challenge the mission of the group, their leader and it may end with face-to-face conflict. The feeling of trust should be built in a team and the members should be encouraged to say what they think, when they need help. Little conflict may be a good thing for the team.
- **Norming** – it is a stage when they know each others better and they start to respect the rules, the authority and they start appreciating other points of view, they feel comfortable asking for feedback and help and giving feedback.
- **Performing** – it is a full potential stage of the group development, participants take their roles and responsibilities, and they perform best to reach the goal,
- **Adjourning**. The end of teams' journey when the project ends.

### 2.6. TUCKMAN'S MODEL OF TEAM DEVELOPMENT

Using the Tuckman's model will help you with the development of your group. You can use the model to ensure that you're doing the right thing at the right time. It is not a one direction model; you can move back with your team. The following steps may help you with the development of your team:

- Think about the Tuckman's stages and try to identify where is your team
- Think about what is needed to move to the next stage
- Think regularly about the actual stage of development of your team and try to adjust your leadership

## 2. COLLABORATION

### 2.7. RELATIONSHIPS LENCIONI MODEL

Relationships are important at every stage and area of our life. Friendships at work, which are the informal and voluntary relationships among employees, have been shown to positively impact performance, creativity, job satisfaction, organizational commitment, job involvement and team cohesion (Morrison & Cooper-Thomas, 2015).



*Lencioni Model. Source: own*



*Relationships. Source: Gerd Altmann Pixabay*

### 2.7. RELATIONSHIPS LENCIONI MODEL

Unfortunately, all teams are difunctional, even those that are perfectly managed with qualified members and perfect environment. This is because there is always a human factor, and all team members are only human beings with all their drawbacks.

Team disfunctions by Lencioni:

1. Trust – absence of trust. Trust gives the team members the permission to be vulnerable, to show their weaknesses to the group. When trust is not established in a group, team members will hesitate to ask for or offer help, will shy away from constructive feedback. They will also fail to get a clear view on each other's intentions.
2. Fear of conflict – when there is no trust in a group people do not involve in a controversial discussion as they do not feel secure. Thanks to trust in a group even conflicts can be constructive and team members feel safe. They are able to state controversial points of view and not to avoid them when trust is missing.
3. Lack of commitment - that individual team members will not make sacrifices to achieve results as a team. But when a trust and conflict are present then team follow the chosen idea and support it.
4. Accountability – when there is no commitment it is impossible to reach accountability of people. When they are committed, they are responsible and respect other members' input.
5. Results – team members have their own personal goals connected with their career and they are always more important than the team goal. When there is accountability in the team then it is much easier to follow the common team goal by all members, the team goal becomes more important than any individual's personal goal and will everyone feel rewarded by being part of the team results.

## 3. DECISION MAKING

### 3.1. INTRODUCTION

Let's start this module with some basic definitions that will clarify the content included in the module.

#### **What is the decision ?**

A choice that you make about something after thinking about it: the result of deciding.

<http://www.merriam-webster.com/dictionary/decision>

#### **What is Decision Making?**

The thought process of selecting a logical  
choice from the available options

<http://www.businessdictionary.com/definition/decision-making.html>

**Decision making** - the process of making choices, esp. important choices:

<https://dictionary.cambridge.org/pl/dictionary/english/decision-making>

## 3. DECISION MAKING



### 3.1. INTRODUCTION

#### **What is a paradox of choice?**

It is a situation when we have a lot of options, and we are not able to choose. Having many options to choose from makes people stressed and overwhelmed rather than happy because they can get what they want.

*“Learning to choose is hard. Learning to choose well is harder. And learning to choose well in a world of unlimited possibilities is harder still, perhaps too hard”* Barry Schwartz in his book The Paradox of Choice



### 3.2. WHAT IS CRITICAL THINKING?

Decision-making process nowadays is very complicated and influenced by many factors. Uncertainty and constantly changing circumstances challenge our approaches to problems and put us in the position of not being sure what is the real problem and what are the causes that create these problems. We misunderstand the world that we live in with many problems with distinguishing what is real and what is not. Technology put us in an even more complicated position playing with the distance, we never know what is local and what is distance. Critical thinking helps in making decisions, and selecting the best option, it is a starting point for reasoning in the decision-making process. We have to remember that asking questions is the basis of critical thinking.

### 3.2. WHAT IS CRITICAL THINKING?

..the ability to analyze facts, generate and organize ideas, defend opinions, make comparisons, draw inferences, evaluate arguments and solve problems (Chance, 1986, p. 6);

...a way of reasoning that demands adequate support for one's beliefs and an unwillingness to be persuaded unless support is forthcoming (Tama, 1989, p. 64);

...the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action (Scriven & Paul, 1992);

...skillful, responsible thinking that facilitates good judgment because it (1) relies upon criteria, (2) is self-correcting, and (3) is sensitive to context (Lipman, 1995, p. 146).

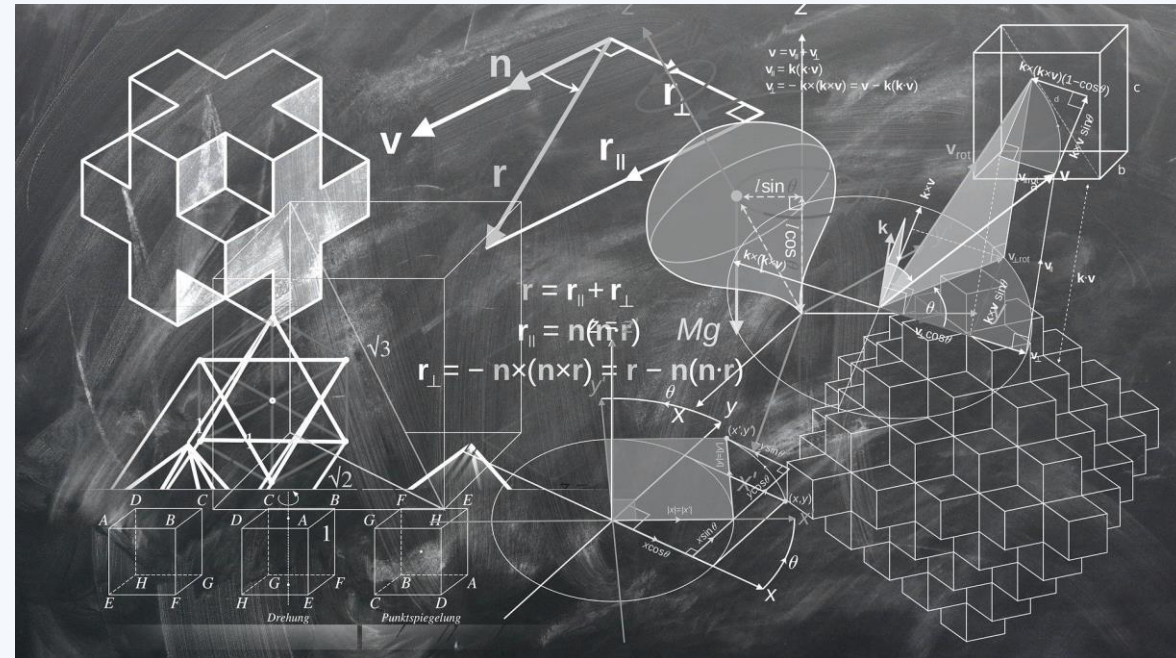
## 3. DECISION MAKING

### 3.3. WHAT IS THINKING?

Thinking is the action of using one's mind to produce thoughts (Source: <https://www.merriam-webster.com/dictionary/thinking>)

Types of thinking:

- collaborative thinking
- curious thinking
- reflective thinking
- flexible thinking
- persistent thinking
- analytical thinking
- creative thinking



Source: Gerd Altmann Pixabay

### 3.3. WHAT IS THINKING?

**What are the characteristics of a good critical thinker? How to become a critical thinker?**

- the willingness to explore, test, and compare other people's points of view, alternative points of view
- be open-minded and eager to question your thoughts, to review your thoughts
- be positive and honest
- be unbiased in thinking and making affirmations
- avoid being wise about your own opinions
- be courageous in approaching the ideas, you may support not a popular idea
- be empathetic, look at the ideas of other people with understanding of their reasoning
- do not be selfish
- do not give up on your ideas
- show and express your ideas independently without any social conformity

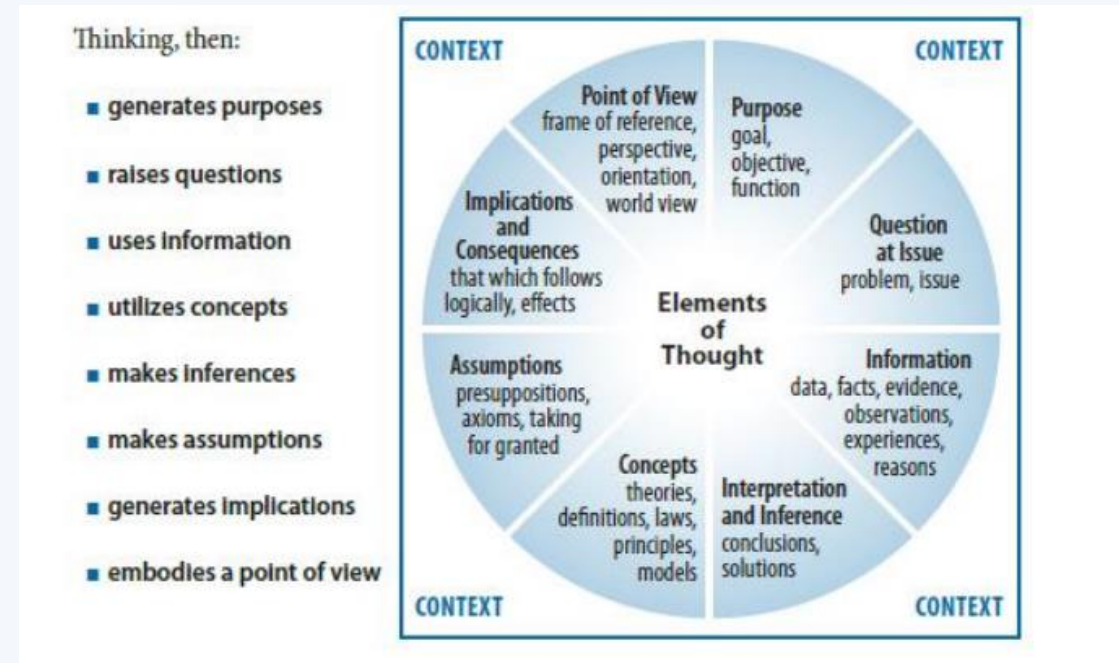
## 3. DECISION MAKING

### 3.4. A MODEL FOR CRITICAL THINKING BY RICHARD PAUL

Richard Paul is an academic from the Foundation of Critical Thinking and he made a model for developing critical thinking skills, the wheel of reasoning.

The model can be explained by the elements of thinking:

- Purpose/goal – what is the objective of analyzing?
- Question/Problem - what is the right question that we should answer?
- Information/data facts – what data is available and what sources?
- Interpretations and Interference what are the correlations and connections that are unbiased?
- Concepts – are there any related theories? what are the principles, models?
- Assumptions - what are the initial beliefs that we took for granted?
- Implications and Consequences - what are the consequences of our conclusions?
- Point of view - what is the reference framework and the perspective?



Model of reasoning. Source:  
<https://www.criticalthinking.org/files/Richard%20Paul%20Biographical%20Information.pdf>

## 3. DECISION MAKING

### 3.4. A MODEL FOR CRITICAL THINKING BY RICHARD PAUL

According to the Foundation for Critical Thinking we can distinguish the following Intellectual standards of Critical thinking <http://www.criticalthinking.org/>.

- Clarity We must be clear in how we communicate our thoughts, beliefs, and reasons for those beliefs and free from confusion and ambiguity.
- Accuracy We must be accurate and provide adequate information and be free from errors, mistakes, or distortions.
- Precision We must be accurate, definite, and exact, it involves working hard at getting the issue under consideration before our minds in a particular way.
- Relevance We must bear upon or relate to the matter at hand.
- Depth We must also deal with the complexities of the issue.
- Breadth We should recognize insights in more than one side of a question.
- Logic We should be able to conduct reasoning according to strict principles of validity, concepts, and assumptions
- Significance We must be worthy of attention, importance, having relative importance.
- Fairness We should search to be -minded, impartial, and free of biases and preconceptions that distort our thinking

## 3. DECISION MAKING



### 3.4. A MODEL FOR CRITICAL THINKING BY RICHARD PAUL

#### Reasoning by Richard Paul & Linda Elder

To improve your way of thinking you should be aware of the following parts of thinking and should be able to assess these parts of thinking. You should be also able to implement the before-mentioned standards of thinking. The guideline on how to improve your thinking:

**PURPOSE** – there is always a purpose in the reasoning so take your time and think about the purpose, state it, and define and separate it from other related purposes. Do not forget to revise your purpose and update it, check if you follow your purpose. Always check if your purpose is realistic.

**QUESTION** It is always about solving some problems or figuring something out so take your time to state the question and try to break it into several sub-questions. Think about and identify if the question has only one right answer or is it a matter of opinion or requires reasoning from more than one point of view.



## 3. DECISION MAKING

### 3.4. A MODEL FOR CRITICAL THINKING BY RICHARD PAUL

#### Reasoning by Richard Paul & Linda Elder

**ASSUMPTION** It is based on assumptions. Think about your assumptions and how they shape your point of view. Think about the fairness and justification of your assumptions.

**POINTS OF VIEW** – our reasoning is based on our points of view, and it influences the process of reasoning so think about your points of view and try to define them. Try to find other points of view and analyze them seeking their strengths and weaknesses

**DATA, INFORMATION, EVIDENCE:** Gather sufficient information and restrict your opinions to those supported by the information you have. You should be able to gather the data, information that supports and that oppose your position and be sure that the data you have is clear and relevant



Source: melovess.com Pixabay

## 3. DECISION MAKING



### 3.4. A MODEL FOR CRITICAL THINKING BY RICHARD PAUL

#### Reasoning by Richard Paul & Linda Elder

CONCEPTS, IDEAS: Consider different concepts, identify key concepts, alternative concepts and use them with care and precision

INFERENCES/ INTERPRETATIONS on the basis of which you draw CONCLUSIONS and give meaning to data be careful with inferences and identify the assumptions that lead to your inferences and infer only on the basis of evidence

IMPLICATIONS and CONSEQUENCES: consider all consequences and implications and think ahead about them, search for them, consider positive and negative implications

## 3. DECISION MAKING

### 3.5. GROUP DECISION MAKING

We can distinguish the following methods of group decision making :

1. Majority – It is a fair approach; many people accept it and know how to implement that and give fast decisions. On the other hand, some people may feel still left behind, it is not effective and may cause some confusion in the group.
2. Minority decision making associated not only with high gains if correct, but also with high losses if wrong, it can be very risky.
3. Decision taken by and Expert – it is a very easy, fast and accurate method but can be also unfair as some members may be not involved and they may not trust in expert.
4. Authority decision with no input from the group – it is a difficult situation when an authority says what is the decision without any participation of any group member. It can be sometimes considered as an advantage as it is fast and binding and some groups may need that.
5. Authority decision supported by group input. Group members are consulted, they are listened to, their thoughts and ideas are part of this whole decision process. There may be a lot of confusion about this type of decision still.
6. Consensus – it is not always a good solution, but it can be very successful. It takes time, it can be long lasting but finally it is fair.

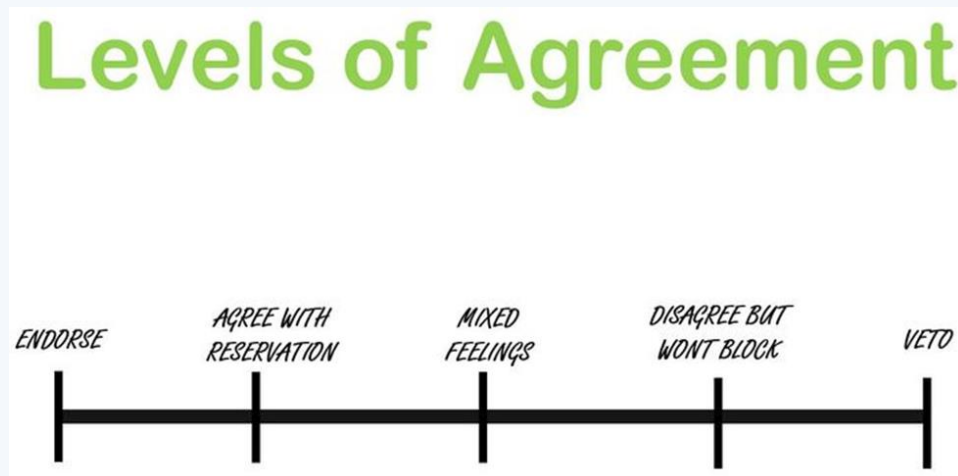
#### Examples of majority rule techniques

- Show of hands
- Polling
- Thumbs up or thumbs spectrum
- Ranking using criteria
- Dot voting
- Pros and Cons
- Gradients of Agreement
- Other

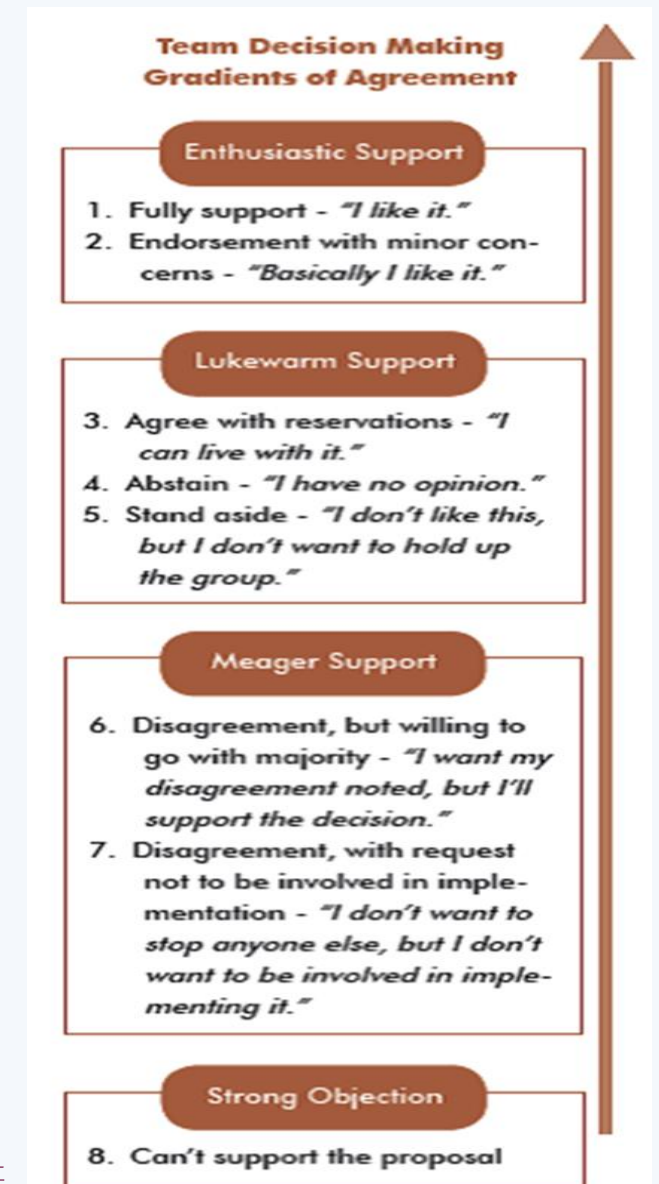
# 3. DECISION MAKING

## 3.6. GRADIENT OF AGREEMENT

Some decisions need a high level of agreement, while others need a relatively lower level of agreement. There can be eight gradients of agreement, from “Strong Objection” to “Enthusiastic Support”. It gives the team members a choice of vocabulary to indicate their level of support for a proposal.



Source: [https://www.canr.msu.edu/news/gradients\\_of\\_agreement\\_can\\_help\\_move\\_groups\\_forward](https://www.canr.msu.edu/news/gradients_of_agreement_can_help_move_groups_forward)



Source: <https://www.trg-inc.com/resources/team-decision-making-the-gradients-of-agreement/>

### 3.7. OBSTACLES TO DECISION-MAKING

1. Bounded rationality – it is connected with our brain and its limits to process and provide/remind information. We are not able to process all information and we cannot fully grasp all the possible alternatives, nor can we understand all the implications of every possible alternative.
2. Escalation of Commitment – we are very often not able to change our decisions when we see that they are not completely correct as we make a commitment and we do not want to change the once taken direction
3. Time – many decisions have to be taken in a limited time and there is not enough time to gather the information needed for the decision or to analyse the information
4. Lot of personal biases that introduce influences into the decision-making process that are separate from the decision itself. They can be confirmation bias when we seek out evidence that confirms our previously held beliefs and we diminish the impact of evidence. Another type of bias is anchoring that is an overreliance on an initial single piece of information or experience to make subsequent judgments. With anchoring it is very difficult to accurately interpret new, potentially relevant information. We can also encounter the halo effect that is the perception that if someone does well in a certain area, then they will automatically perform well at something else regardless of whether those tasks are related. Finally, we can experience the overconfidence bias when we overestimate the reliability of our judgments. This can include the certainty one feels in her own ability, performance, level of control, or chance of success.
5. Conflict – decision making process provokes some conflicts such as process conflict that can be constructive as it is focused on tasks and not on people and relationship conflict that focuses on people and is based on personality differences and this type of conflict is destructive.

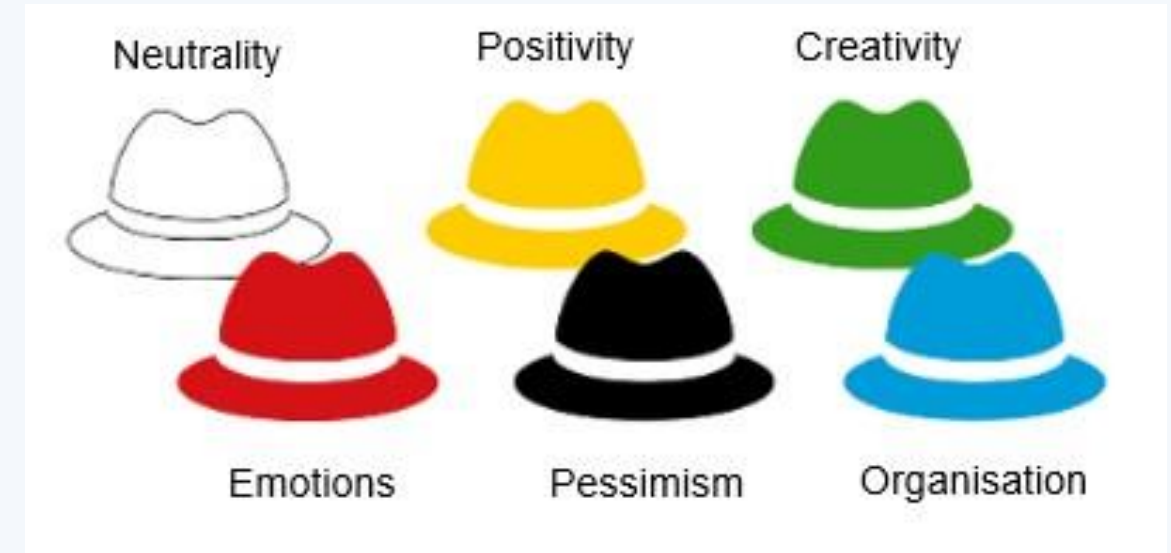
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## 3. DECISION MAKING

### 3.8. 6 THINKING HATS

Based on the Edward de Bono theory we can distinguish 6 thinking hats. These techniques (hats) focus on enhancing the structure of thinking so that group decision making, and idea evaluation can be dramatically improved. The hats are on our heads and indicate directions on what has happened, what has been said. There are lots of differences between hats. Hats indicate what is about to happen. The 6 thinking hats method is based on the parallel thinking method. In this method, everybody is working in the same direction. The method encourages team building and collaboration, it allows different ideas development without pointless arguing between participants.



6 thinking hats. Source: <https://think2make.ch/en/6-thinking-hats/>



### 3.8. 6 THINKING HATS

The colours of hats:

- **White hat:** neutral and objective point of view, based on existing data, facts and figures without any judgement. The white colour is neutral and indicates neutrality. White hat does not give any interpretations or opinions. The white hat also indicates likelihood. White hat thinking is discipline.
- **Red hat:** based on your emotions, intuition and judgement. Brings an emotional view. You can decide to use your feelings by putting a red hat on or switching off the feeling by taking the hat off. With the red hat, you can ask about the feelings of others. Red hat is also opinion.
- **Black hat:** gives serious opinions, is cautious. Share with others why you believe the project is not promising, show all the weaknesses of the project. Black hat is about risks, dangers, obstacles, problems. Black hat points our attention to things that may be weak or harmful. It is the hat much about; if its fits'. Does the Solution fit our financial resources
- **Yellow hat:** brings out all the positive aspects, is optimistic and constructive. The yellow hat is like the sun, sunshine, Energy. It is the positive assessment based on logical as well as dream and hopes aspects. It is about visions and dreams.
- **Green hat:** is creativity and new ideas, is imaginative, the search for alternatives that go beyond and obvious. Provocation goes with green hat thinking.
- **Blue hat:** it is the disciplinary hat, controlling, organising the thinking process. The blue hat is thinking about the thinking, about the process. Blue hat thinking is about planning, making conclusions, summarizing, monitoring the process and about choosing which hat to use, what sequence of hats implement.

## 3. DECISION MAKING

### 3.8. 6 THINKING HATS

You should always refer to the colour of the hat and not to the function of the hat. It is the rule of the method.

#### How to use the hats?

You can request somebody to put on the hat, to take it off. You can also choose to put it on or take it off. They can be either used to request a type of thinking or to find a solution to the problem or to investigate the problem. There are several uses of hats:

#### 1. Single use

You can just request use of a certain hat, for instance: we get stuck with some financial decisions and a CEO says that: We need some green hat thinking here or the Black hat approach would help here.

#### 2. Sequence use

The sequence of hats is fixed before the meeting and presented to the participants. Participants should follow exactly the sequence, so they cannot change the hat or choose another hat. One hat is planned for a certain period of time and then follow the next hat. The facilitator should fix also time for each hat. Blue hat should Begin and close the session. Blue hat is the definition of rules, goals, plan.

3. **Groups discussion.** Facilitator assigns a hat to each person to discuss their approach, or all group members wear the same hat to discuss the same perspective before proceeding to the next hat. It's a good idea to rotate the hats between each member to foster as many new ideas as possible and make everyone think from different perspectives.

4. **Individually in a group.** Facilitator can always ask to think in a certain colour of the hat.

## 4. CONCLUSIONS

### 3.8. 6 THINKING HATS

**Collaboration** is the process of two or more people or organizations working together to complete a task or achieve a goal or to achieve shared goals.

**Collaboration software:** Zoom; Microsoft TEAMS; Facebook; Google workspace

**Decision Making** is the thought process of selecting a logical choice from the available options.

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# Fostering diGitalisation and blonic transformation of SMEs through the development of a novel and innovative Training material for overcoming COVID-19 crisis

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**Thank  
you**

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# TU3. LU. 11

**TRAINING UNIT 3 – BT MANAGEMENT**

**LEARNING UNIT 11- SYSTEM THINKING**



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## 1. Systems thinking and its impact on bionic success

### 1.1 Definition of Systems Thinking

### 1.2 Benefits of the Systems Thinking

### 1.3. Path to Systems Thinking in the digital world

### 1.4. Business Models; difference of legacy and digital companies

### 1.5. Benefits of the bionic model

### 1.6 Definition of the bionic company

## 2. Digital transformation and Systems Thinking

### 2.1. Systems Thinking in digital ecosystem

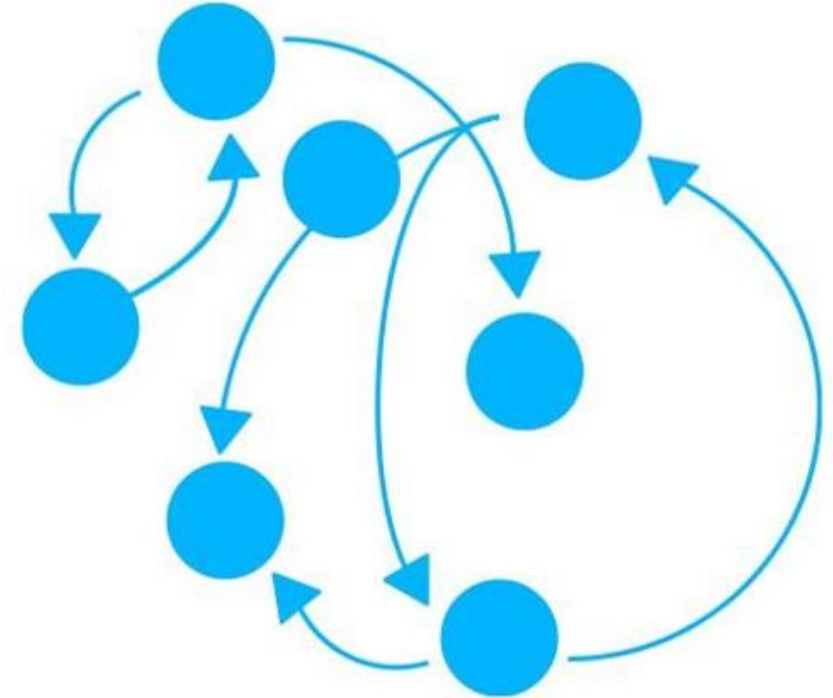
### 2.2. Approach to digital transformation through Systems Thinking

### 2.3. Creating a digital roadmap with Systems Thinking

### 2.4 Data collection and evaluation

## 3. Practical real case

## 4. Conclusions



Source : <https://bootcamp.uxdesign.cc/how-does-systems-thinking-help-design-thinking-4553a7133e38?gi=580b78f7d1ae>

# 1. SYSTEMS THINKING AND ITS IMPACT ON BIONIC SUCCESS

## 1.1. DEFINITION OF SYSTEMS THINKING

Systems Thinking is a holistic approach to analysing and understanding:

- how the system's constituent behaviours and elements interrelate.
- how they change over time, and how they fit in the context of a larger system.

It is not a tool, but it is enabled through **the right set of data models, tools, processes and underlying platforms**.

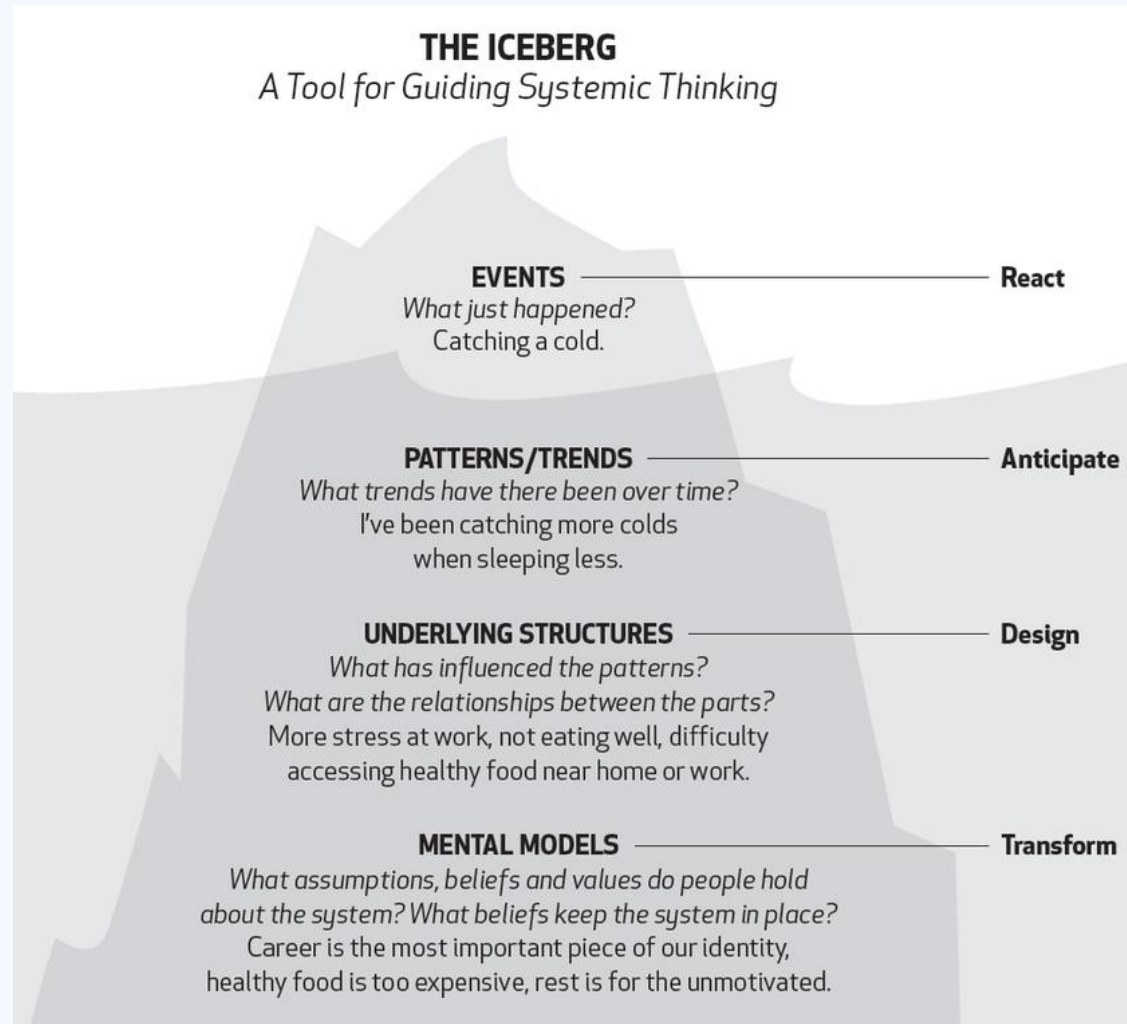
Systems Thinking is very relevant to **Digital Transformation** since it also focuses on the transformation of the same data models, tools, and processes.

Systems Thinking is meant to be a permanent characteristic of the enterprise's approach to product conception, design, manufacturing, asset operation, maintenance, and disposal and the continuous feedback between all of these. It allows **Digital Transformation** to continuously evolve [1].

Briefly to say, Systems Thinking is an **interdisciplinary cognitive model and modelling tool** that explains problems through systems. Against the background of complexity reduction, multidimensional systems are better understood and decisions can be made more easily [2].

# 1. SYSTEMS THINKING AND ITS IMPACT ON BIONIC SUCCESS

## 1.1. DEFINITION OF SYSTEMS THINKING



Source: <https://medium.com/systemic-design-group/systems-thinking-what-is-it-all-about-1e5135de97b3>

# 1. SYSTEMS THINKING AND ITS IMPACT ON BIONIC SUCCESS

## 1.1. DEFINITION OF SYSTEMS THINKING

In Systems Thinking, people use ways of thinking, methodologies, and instruments that enable them to gain a better understanding of the dynamical complexity of systems.

This enables one to predict future developments, recognize key points of leverage, and create more promising ways to transform the system into a more sustainable state.

The goal is to look underneath the individual events on the surface to see the trends as time goes on. These trends are also called patterns or system behaviour [3].

Systems thinking is designed to assist people in dealing with complex environments. It presents a range of analytical tools that help people make sense of the complexity they are presented with. These tools assist people in uncovering the patterns and structures beneath the surface and how they interact with each other.

These tools can be used to build a "virtual world" - a simplified representation of the real world that is simple enough for our minds to grasp and detailed enough to help us make decisions. They enable people to predict future developments in the system and to develop systems theories of change that evaluate the potential (unintended) consequences of interventions [3].

# 1. SYSTEMS THINKING AND ITS IMPACT ON BIONIC SUCCESS

## 1.1. DEFINITION OF SYSTEMS THINKING

The tools fulfil their second purpose as “boundary objects”. Just like a geographical map for a group of travellers, they provide a physical object that people gather around and point to different spots to make sure everyone has a common understanding.

Systems thinking supplies the artefacts and associated processes to connect the stakeholders. Even with increasing data gathering and analyses, the majority of knowledge about how a system operates and how decisions are made resides in the minds of the system's stakeholders.

In moderated workshops, stakeholders can exchange their experiences with the system and integrate their perspectives into an overall picture [3].

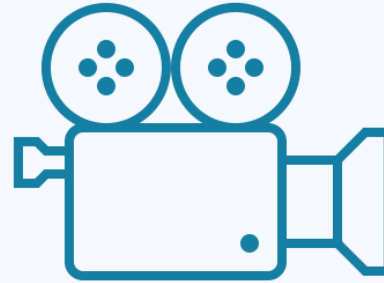
Systems thinking promotes a rethinking of the way we view and interact with the world.

Decision making starts to become less of a tale of heroic individual leadership and more about the skill of listening, making connections, following, and promoting collective intelligence.

People have to all become "systems learners" and be explicit in their thinking, continuously challenging their perceptions of the world and carefully give attention to the system and the actors within it [3].

# 1. SYSTEMS THINKING AND ITS IMPACT ON BIONIC SUCCESS

## 1.1. DEFINITION OF SYSTEMS THINKING



*What is Systems Thinking?*



*A Systems Story (Systems Thinking)*



*Adopting Systems Thinking and Design Thinking to solve daily problems | Pragma Saboo | TEDxXIE*

# 1. SYSTEMS THINKING AND ITS IMPACT ON BIONIC SUCCESS

## 1.1. DEFINITION OF SYSTEMS THINKING

### THE 6 BASIC CONCEPTS OF SYSTEMS THINKING

#### 1. Interconnection

Systems thinking requires a change in thinking, **away from linear focusing on circular thinking**. The basic principle of this change is that everything is interconnected. Everything needs something else, often a complex set of other things, to survive, even inanimate objects depend on other things like in the biological sense. It is like changing our view of the world from a linear, structured worldview to a dynamic, chaotic, interconnected, complex relations and feedbacks [4].

#### 2. Synthesis

Synthesis generally means **combining two or more things to create something new**. Synthesis is about understanding the whole and the parts simultaneously, as well as the relationships and connections that creates the dynamics of the whole. Basically, synthesis is the ability to see connections [4].

#### 3. Emergence

From a systems perspective, we know that larger things are created from smaller parts: emergence is the natural result of things coming together. Emergence is the result of the synergies of the parts; it's about nonlinearity and self-organization [4].



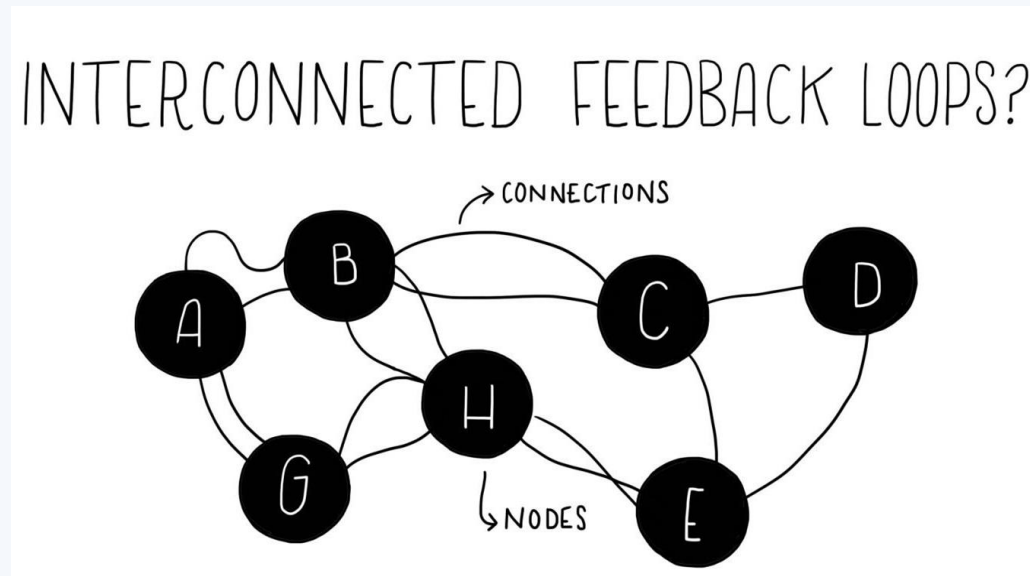
# 1. SYSTEMS THINKING AND ITS IMPACT ON BIONIC SUCCESS

## 1.1. DEFINITION OF SYSTEMS THINKING

### THE 6 BASIC CONCEPTS OF SYSTEMS THINKING

#### 4. Feedback loops

Because everything is linked, there are continuous feedback loops and flows between the elements of a system. We can observe, understand, and interfere with feedback loops once we understand their nature and dynamics [4].



Source: <https://medium.com/disruptive-design/tools-for-systems-thinkers-the-6-fundamental-concepts-of-systems-thinking-379cdac3dc6a>

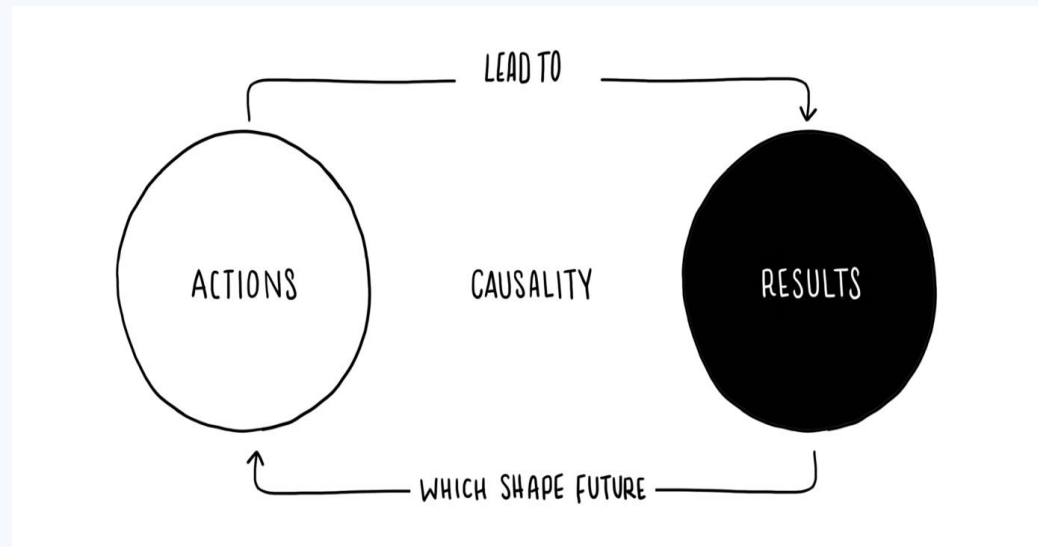
# 1. SYSTEMS THINKING AND ITS IMPACT ON BIONIC SUCCESS

## 1.1. DEFINITION OF SYSTEMS THINKING

### THE 6 BASIC CONCEPTS OF SYSTEMS THINKING

#### 5. Causality

Causality as a concept of systems thinking is about decoding the ways in which things in a system affect each other. To understand causality results in a deeper view of agency, feedback loops, connections, and relationships, all of which are essential components of systems mapping [4].



Source: <https://medium.com/disruptive-design/tools-for-systems-thinkers-the-6-fundamental-concepts-of-systems-thinking-379cdac3dc6a>

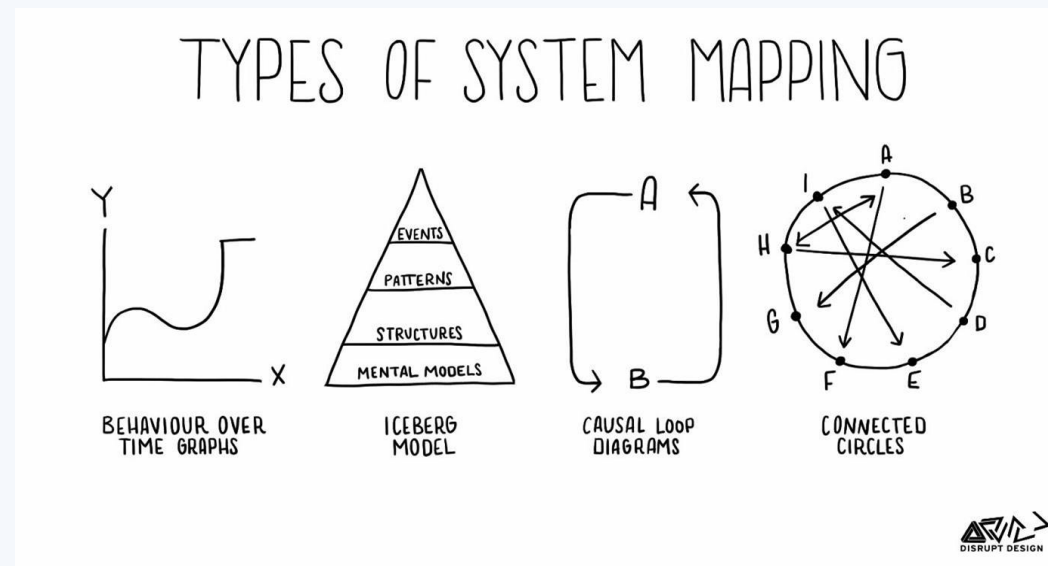
# 1. SYSTEMS THINKING AND ITS IMPACT ON BIONIC SUCCESS

## 1.1. DEFINITION OF SYSTEMS THINKING

### THE 6 BASIC CONCEPTS OF SYSTEMS THINKING

#### 6. Systems Mapping

Systems mapping is about identifying and mapping the elements of "things" within a system to understand how they are connected, interrelated, and function in a complex system. Based on this, unique insights and discoveries can be used to develop interventions, changes, or policy decisions that change the system in the most efficient way [4].



Source: <https://medium.com/disruptive-design/tools-for-systems-thinkers-the-6-fundamental-concepts-of-systems-thinking-379cdac3dc6a>

# 1. SYSTEMS THINKING AND ITS IMPACT ON BIONIC SUCCESS

## 1.1. DEFINITION OF SYSTEMS THINKING

### THE 6 BASIC CONCEPTS OF SYSTEMS THINKING

#### 6. Systems Mapping

People are using the system map to navigate and provide structure to overwhelming set of information. System maps are most efficient when bringing people together.

System mapping allows people to predict their present position, the road ahead, and the actions that will help them navigate their lodestar [3].

#### 6.1. Systems Mapping Example

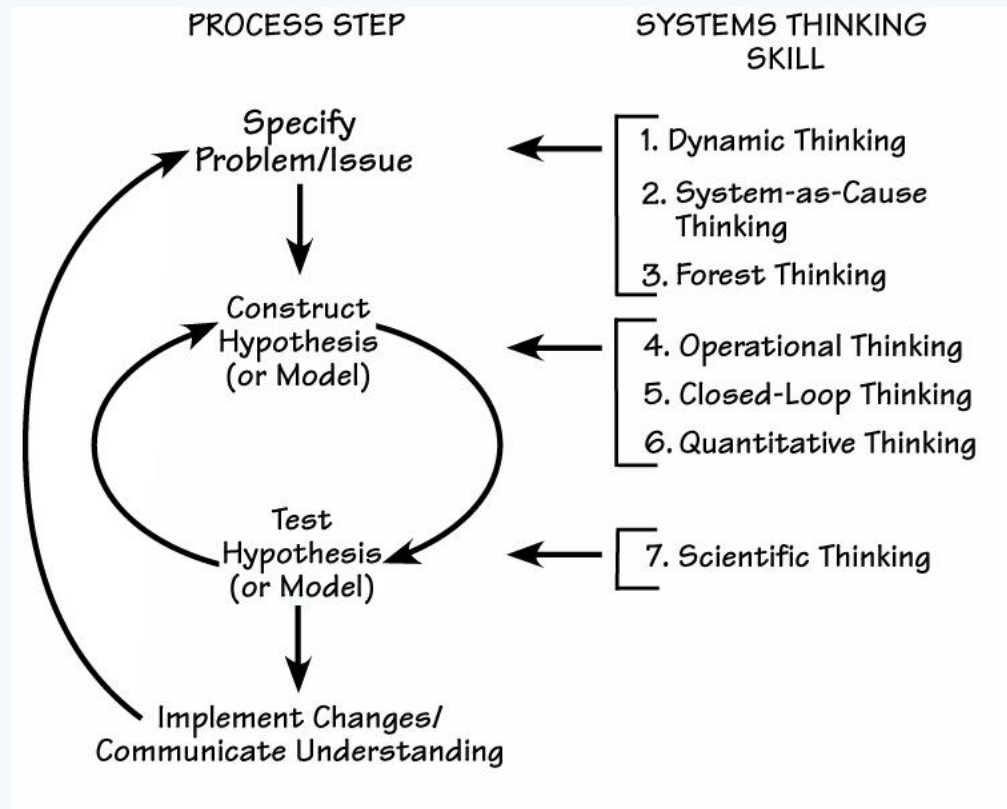
Original name of the figure 4 is “What drives adequate housing?” It is a system map that presents the factors and cause-and-effect relations related to adequate urban housing in an East African country. The map was co-developed with a regional NGO and various housing sector stakeholders to support the development of strategic interventions [3].



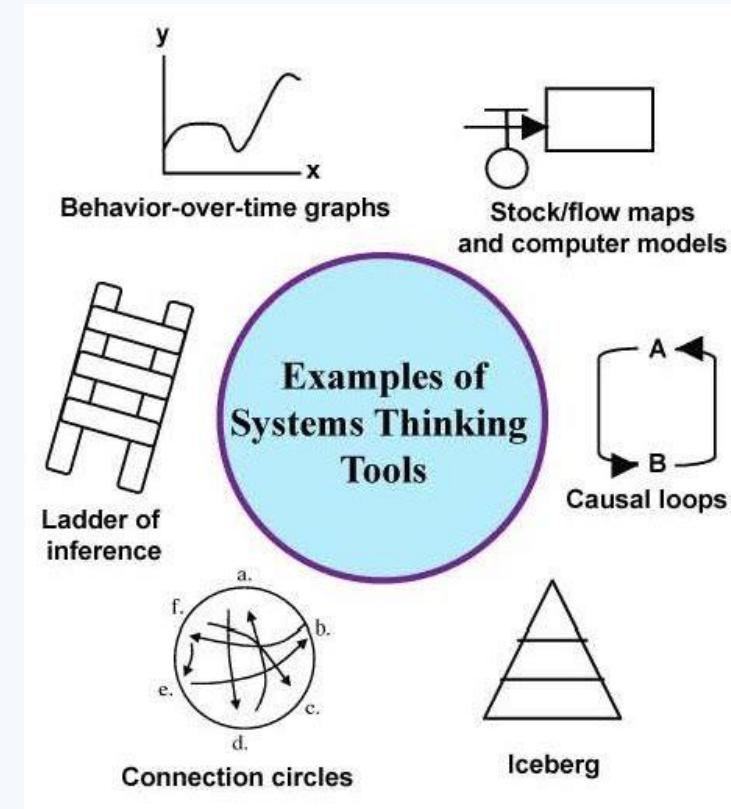
Source.: <https://medium.com/systemic-design-group/systems-thinking-what-is-it-all-about-1e5135de97b3>

# 1. SYSTEMS THINKING AND ITS IMPACT ON BIONIC SUCCESS

## 1.1. DEFINITION OF SYSTEMS THINKING



Source: <https://rri-tools.eu/-/an-introduction-to-systems-thinking-and-systemic-design-amp-x2013-concepts-and-tools>



Source: <https://thesystemsthinker.com/the-thinking-in-systems-thinking-honing-your-skills/>

# 1. SYSTEMS THINKING AND ITS IMPACT ON BIONIC SUCCESS

## 1.2. BENEFITS OF THE SYSTEMS THINKING

Systems Thinking is essential for the **identification and mitigation** of unwanted emergent features in complex systems. Its **efficacy** relies on company **commitment, employee mindset, methods chosen, tools used**, and platforms where **product lifecycle** is managed.

It enhances the value and effectiveness of Digital Transformation and **identifies the risks** really early. It eliminates intentional over-planning and manages **better processes for the introduction of new technologies**. It conservates **time, resources, and costs** [5].

Systems Thinking provides you with a set of viewpoints and abilities to describe and **explain the characteristics of complex systems** in order to **optimize** them for a required outcome based on **the insights** gained [5].

System thinkers has the ability to recognize the connections between organisational systems and the outer environment as well as between organisational systems and themselves.

They are able to gather multiple people/perspectives and do not accept a single point of view.

They recognize the complexity of cause-and-effect relationships, are seldom linear and are influenced by many interactive factors [7].



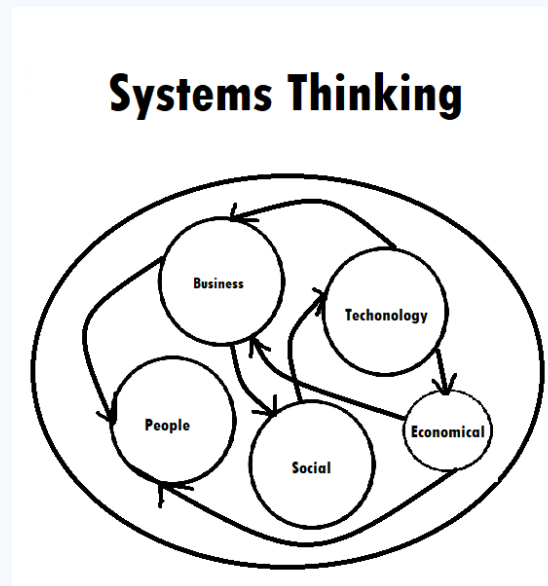
# 1. SYSTEMS THINKING AND ITS IMPACT ON BIONIC SUCCESS

## 1.2. BENEFITS OF THE SYSTEMS THINKING

Systems thinking offers a better language and a more whole and complete way of thinking. Its principles are like the wide-angle lens of a camera. It gives us a more effective way to think, communicate, act and achieve better results [8].

With a systemic approach, you realize that everything is dynamically interconnected. Everyone needs their colleagues to be successful. The systemic style of thinking gives you the skills and tools to build interconnectivity, creativity and productivity in your workplace [9].

It helps you predict the consequences of misjudgements to minimize their impact on the system. Based on the knowledge of a system and how its elements interact, it can be set achievable goals for an organization (more realistic plans).



Source: <https://bootcamp.uxdesign.cc/how-does-systems-thinking-help-design-thinking-4553a7133e38>

# 1. SYSTEMS THINKING AND ITS IMPACT ON BIONIC SUCCESS

## 1.2. BENEFITS OF THE SYSTEMS THINKING



Source: <http://watersfoundation.org/newsletter-archives/march-2014/systems-thinking-assessment-work-together/#.VS6V6n-qtkM.facebook>

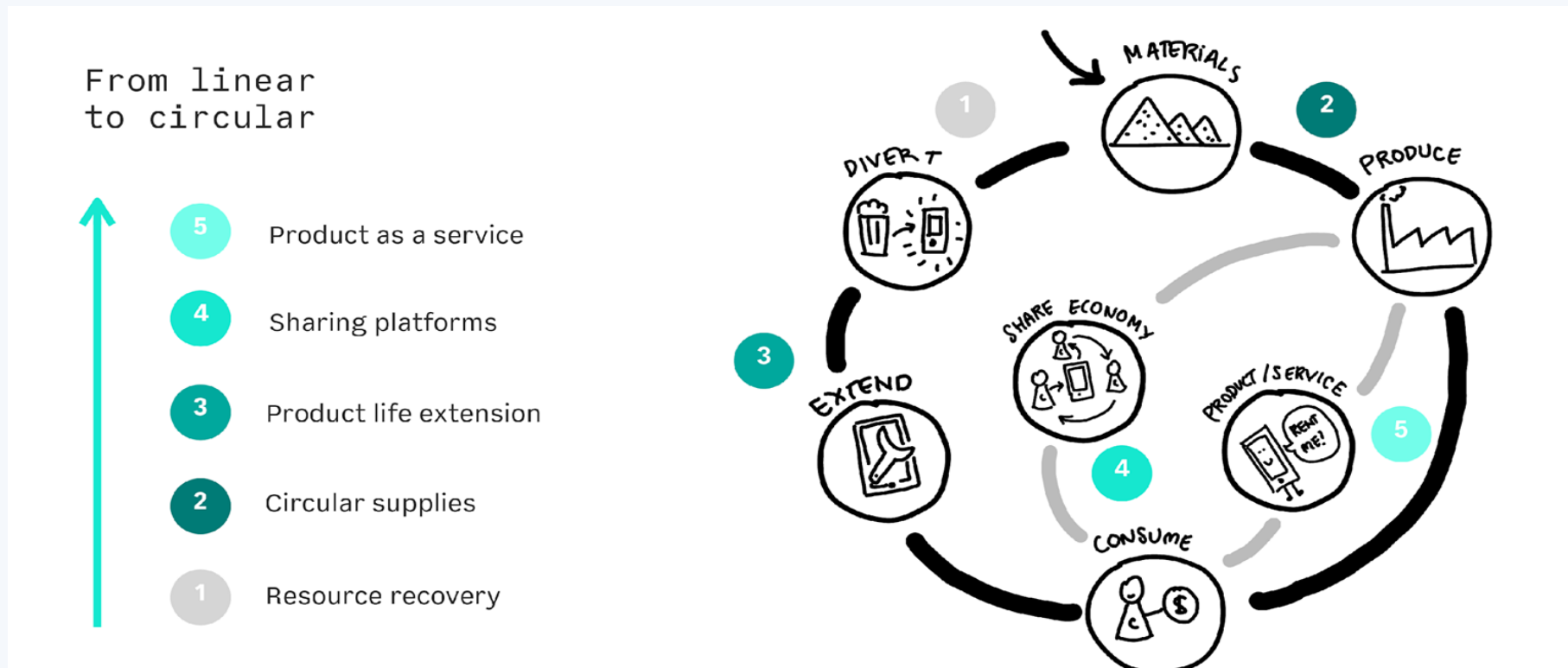
# 1. SYSTEMS THINKING AND ITS IMPACT ON BIONIC SUCCESS

## 1.2. BENEFITS OF THE SYSTEMS THINKING

Taking a systems thinking approach to sustainability allows people to better recognize and understand the impacts of our business decisions and avoid any unintended consequences.

It also allows people to explore possibilities for innovation and develop our approaches to systems change.

Systems thinking is a way of thinking that helps people unravel and deal with the complexity of life on Earth [10].



Source: <https://futuraice.com/blog/systems-thinking-and-sustainability>

# 1. SYSTEMS THINKING AND ITS IMPACT ON BIONIC SUCCESS

## 1.3. PATH TO SYSTEMS THINKING IN THE DIGITAL WORLD

All key business processes must be **redesigned, combining technological and human capabilities** to radically **improve business outcomes**.

To develop the bionic processes, companies must create **new types of teams** to develop and manage the new technology that supports the processes. To develop and manage technology most effectively, **ways of working** must **change** fundamentally.

To enable **rapid product development**, the enterprise must move beyond **infrastructure and transaction-oriented technologies** and **invest** more money and resources in data and smart-product technology layers. To avoid the endless delays and high costs caused by outdated technology models, the technology stack must be **transformed to match the modern, modular architecture** common in agile enterprises [11].



Source: <https://www.apm.org.uk/blog/applying-systems-thinking-to-project-management/>

# 1. SYSTEMS THINKING AND ITS IMPACT ON BIONIC SUCCESS

## 1.4. BUSINESS MODELS; DIFFERENCE OF LEGACY AND DIGITAL COMPANIES

Business models are dynamic, particularly in the face of continuous and ongoing digital transformation. Hence, digital innovation of business models becomes a mandatory requirement for surviving in an ecosystem that is constantly changing [11].

Digital natives operate very differently than legacy companies: They integrate technology and data science into their organizations and processes from the day they are created. That way, all of the company's systems work together without a hitch. Digital natives grow up in a way that builds a cohesive "digital + human" or bionic operating model.

In these days, legacy companies seeking to chase the rapid success of digital companies and have a tendency to copy what they believe are the key success factors. For example, they rebuild the technology stack or assemble a data science team. But they fail to apply systems thinking to the digital transformation process.

The management teams that want to take advantage of the power of digital capabilities need to think systematically about how they can become bionic organizations - combining the power of people and machines to drive better performance across the enterprise and the operating model [7].

# 1. SYSTEMS THINKING AND ITS IMPACT ON BIONIC SUCCESS

## 1.4. BUSINESS MODELS; DIFFERENCE OF LEGACY AND DIGITAL COMPANIES



| LEGACY COMPANIES                                | DIGITAL COMPANIES                                         |
|-------------------------------------------------|-----------------------------------------------------------|
| Hybrid<br>A combination of paper and digital    | Digital and multichannel                                  |
| Legacy system                                   | Digital and web based tools                               |
| Manual<br>People are busy with repetitive tasks | Automated<br>Makes the innovations and development easier |

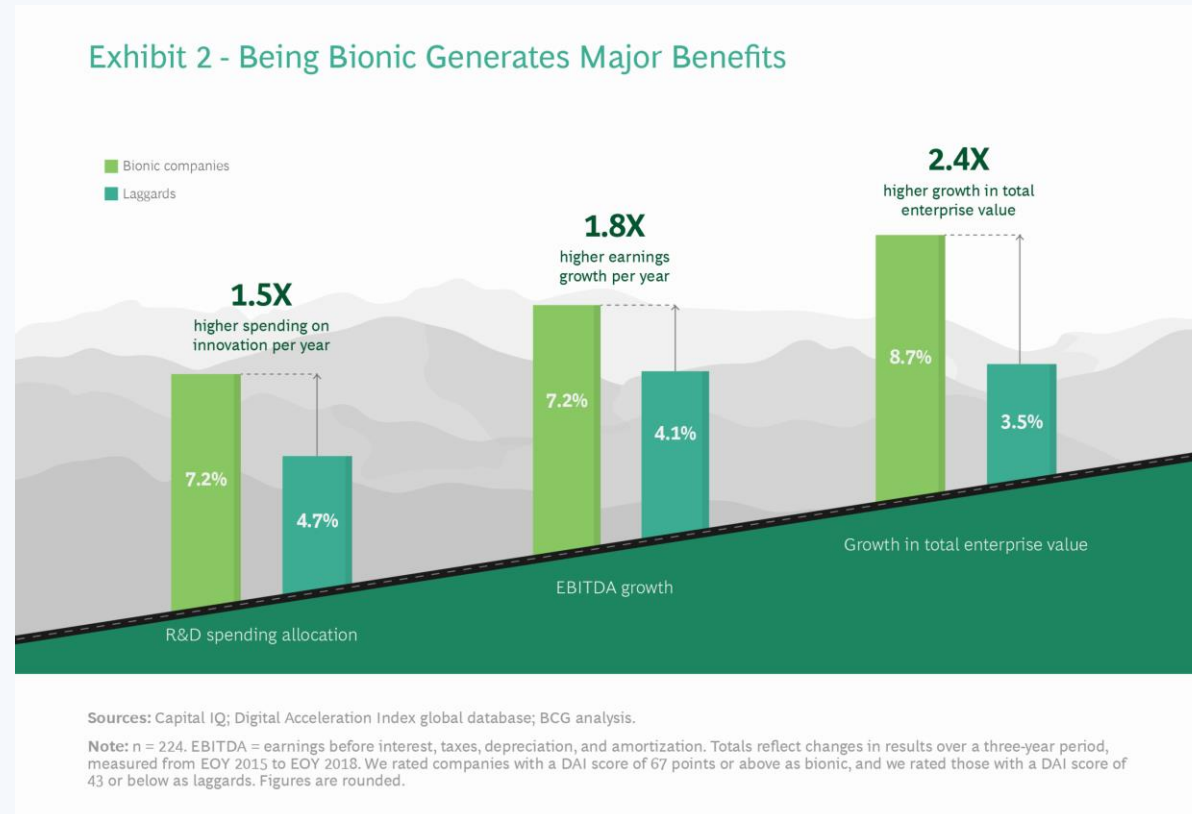
Source: <https://www.cio.com/article/245175/why-enterprise-digital-transformation-efforts-stall.html>

# 1. SYSTEMS THINKING AND ITS IMPACT ON BIONIC SUCCESS

## 1.5. BENEFITS OF THE BIONIC MODEL

Digital success cannot be achieved with a single digital initiative. The absence of one or more key components (such as the right talent, the right technology, or the right organizational structure) will fundamentally diminish the return on any digital investment.

Developing and sequencing the digital transformation agenda takes time, vision, smart investment, and persistence in execution [11].



Source: <https://www.bcg.com/publications/2020/how-bionic-companies-translate-digital-maturity-into-performance>



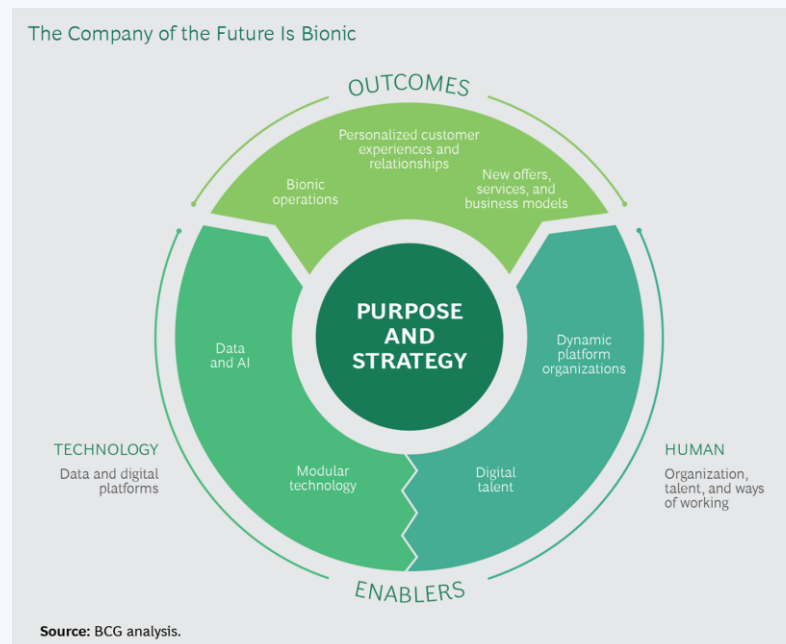
# 1. SYSTEMS THINKING AND ITS IMPACT ON BIONIC SUCCESS

## 1.6 DEFINITION OF THE BIONIC COMPANY

Bionic enterprises expand quickly without leaning only on physical resources such as people and land, or even managing money and investments in an effective way. Their expansion is achieved by building and connecting digitally based, cross-border platforms [12].

The bionic company combines the strengths of humans and technology to create bionic capabilities.

According to bionic companies, to reach its full potential, technology must be integrated with the flexibility, adaptability and extensive experience of people [13].



Source: <https://www.bcg.com/capabilities/digital-technology-data/bionic-company#what-is-bionic-company>.

## 2. DIGITAL TRANSFORMATION AND SYSTEMS THINKING

### 2.1. SYSTEMS THINKING IN DIGITAL ECOSYSTEM

Succeeding in the digital world requires a Systems Thinking approach to business management, and a multidisciplinary way of understanding of the digital ecosystem.

The Systems Thinking and view of the business world is more balanced and aware of emerging factors. It creates a multitude of available options to handle the complexities and uncertainties of the digital world [14].



Source: <https://timreview.ca/article/1260>

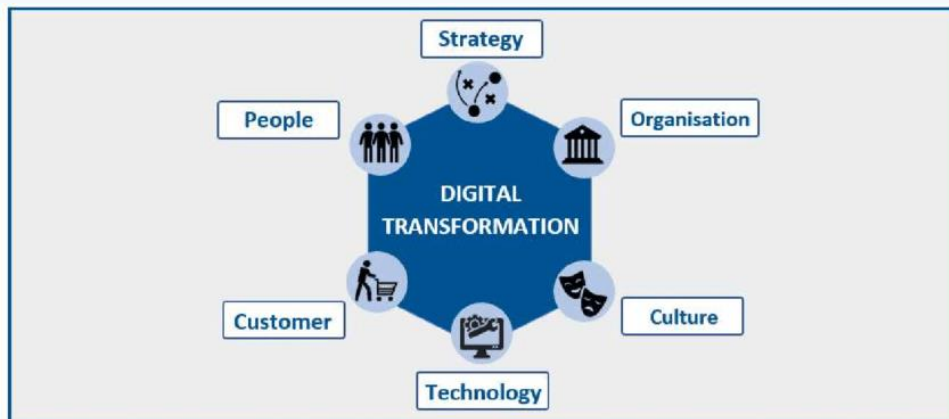
## 2. DIGITAL TRANSFORMATION AND SYSTEMS THINKING

### 2.2. APPROACH TO DIGITAL TRANSFORMATION THROUGH SYSTEMS THINKING

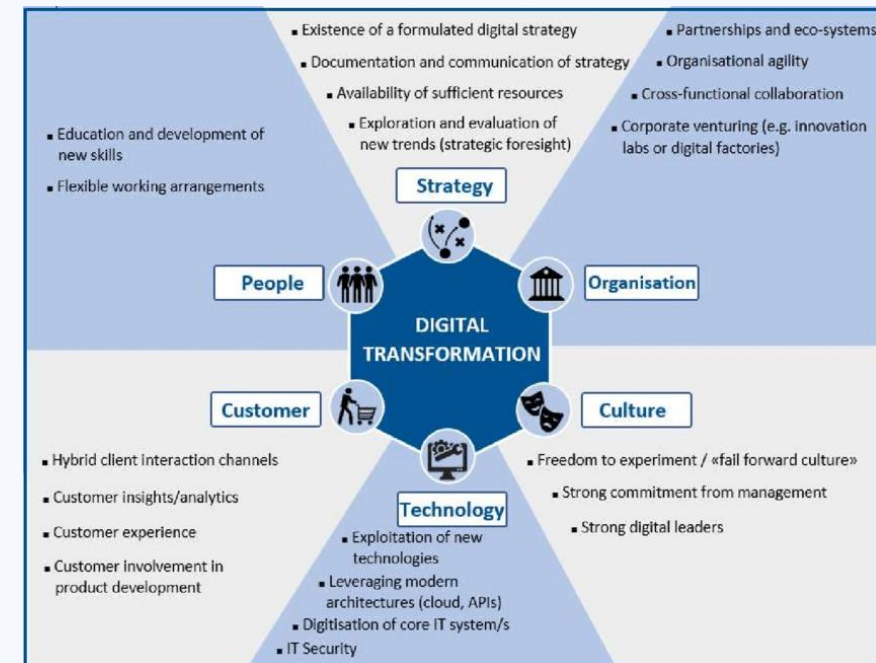
Interactions of different departments or units create new, more efficient measures that streamline the process and make it even more effective.

For example innovations in digital connectedness, such as data tracking, Cloud software, have provided new opportunities for separate departments to interact with each other.

By applying Systems Thinking to digital transformation, companies can begin to move more in the direction of enhanced specialization, predictive data modelling [15].



Source: [https://www.researchgate.net/figure/Digital-Transformation-Framework-own-illustration\\_fig4\\_337167323](https://www.researchgate.net/figure/Digital-Transformation-Framework-own-illustration_fig4_337167323)



## 2. DIGITAL TRANSFORMATION AND SYSTEMS THINKING

### 2.3. CREATING A DIGITAL ROADMAP WITH SYSTEMS THINKING

#### 1) SETTING GOALS

Succeeding in the digital world requires a Systems Thinking approach to business management, and a multidisciplinary way of understanding of the digital ecosystem.

The Systems Thinking and view of the business world is more balanced and aware of emerging factors. It creates a multitude of available options to handle the complexities and uncertainties of the digital world [15].



Source::

<http://www.hollyzimmermann.com/2019/03/setting-goals-in-sports.html>

## 2. DIGITAL TRANSFORMATION AND SYSTEMS THINKING

### 2.3. CREATING A DIGITAL ROADMAP WITH SYSTEMS THINKING

#### 2) PUTTING TOGETHER THE LIST OF NEEDS FROM DIFFERENT DEPARTMENTS

It is important that key stakeholders from each department meet in order to compile the list of requirements, differentiating between those that effect the entire organization and those that are specific to one department [15].



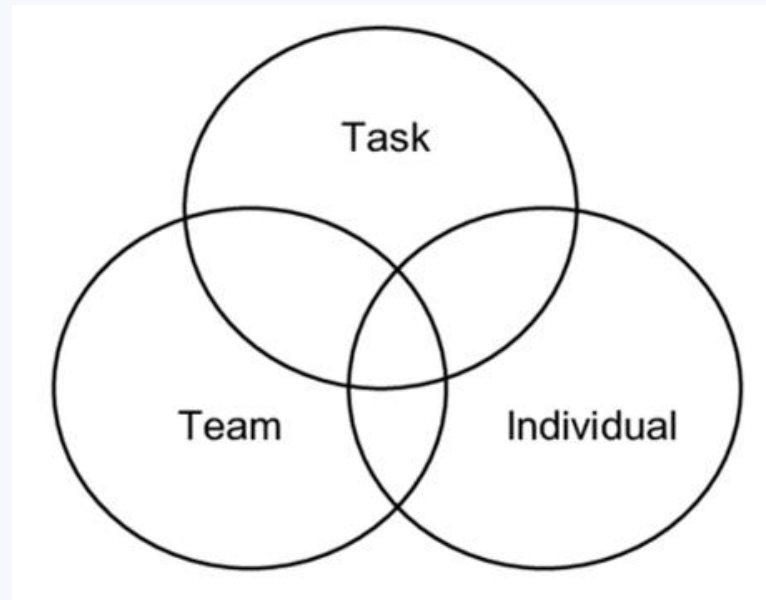
Source: <https://www.teachoo.com/7258/2658/Different-Department-in-Business/category/Departments/>

## 2. DIGITAL TRANSFORMATION AND SYSTEMS THINKING

### 2.3. CREATING A DIGITAL ROADMAP WITH SYSTEMS THINKING

#### 3) DISCUSSING THE OVERLAP OF DEPARTMENTAL NEEDS

With a list of company-wide and unit-specific requirements that digital transformation must meet through Systems Thinking, It should be discussed how departmental requirements overlap [15].



Source: [https://www.researchgate.net/figure/Model-of-team-task-and-individual-needs-overlapping-Adair-1986\\_fig2\\_220590647](https://www.researchgate.net/figure/Model-of-team-task-and-individual-needs-overlapping-Adair-1986_fig2_220590647)

## **2. DIGITAL TRANSFORMATION AND SYSTEMS THINKING**

### **2.3. CREATING A DIGITAL ROADMAP WITH SYSTEMS THINKING**

#### **4) DEFINE THE SOLUTION**

Once it is known what the company and the individual departments want to achieve, it is important to define the solutions that the company wants to implement in the following years.

In a System Thinking-oriented digital transformation, the major change point starts when the first set of solutions has been scaled up. The company has a secure set of digital tools and begins to coordinate the individual systems with each other [15].

#### **5) COLLECTING DATA ON DIGITAL SOLUTIONS, LEARNING FROM THE INSIGHTS AND ADAPTING THE APPROACH**

The business collects data on each of the digital solutions deployed. It means they learn from the experience and adapt the approach.

It is especially important to create a setup that shares this learning so that departmental decision makers can both take advantage of the cross-business actions [15].



## 2. DIGITAL TRANSFORMATION AND SYSTEMS THINKING

### 2.4 DATA COLLECTION AND EVALUATION

Quantitative data is well suited for collecting, summarizing and comparing at scale, but recent advances in using natural language processing, a type of machine intelligence, show that companies can have the tools to process this information without many additional hours of analysis time.

The companies must make sure that they can securely storage the data and that the relevant information is available to key stakeholders [15].

The Systems Thinking approach is enabled because the data is stored in a central location like a cloud server that makes the same information available to everyone who accesses it.

When the connected data collection system is in setup, the company can begin to track the systematic impact of the steps it takes. By analysing, the company can examine the interrelationships and identify often unexpected effects of new solutions [15].

### 3. PRACTICAL REAL CASE

#### A CASE STUDY FROM SCONTRINO-POWELL ( [HTTPS://SCONTRINO-POWELL.COM](https://scontrino-powell.com) )

“ACME Inc.” is experiencing particularly high employee turnover (25% within one year of hire). To address this issue, the **non-systems thinker** may react by implementing new selection methods like an **online personality questionnaire**. However Sue, a Vice-President at ACME, is a **systems thinker**. **Instead of throwing solutions at the problem, she established a cross-departmental task force**. Sue and her team approached the problem with a learning orientation. That is, they were not seeking to reduce turnover but **to gain an understanding of the internal and external conditions that were contributing to turnover**.



Source: <https://scontrino-powell.com/case-studies/systems-thinking-how-to-lead-in-complex-environments>

### 3. PRACTICAL REAL CASE

#### A CASE STUDY FROM SCONTRINO-POWELL ( [HTTPS://SCONTRINO-POWELL.COM](https://scontrino-powell.com) )

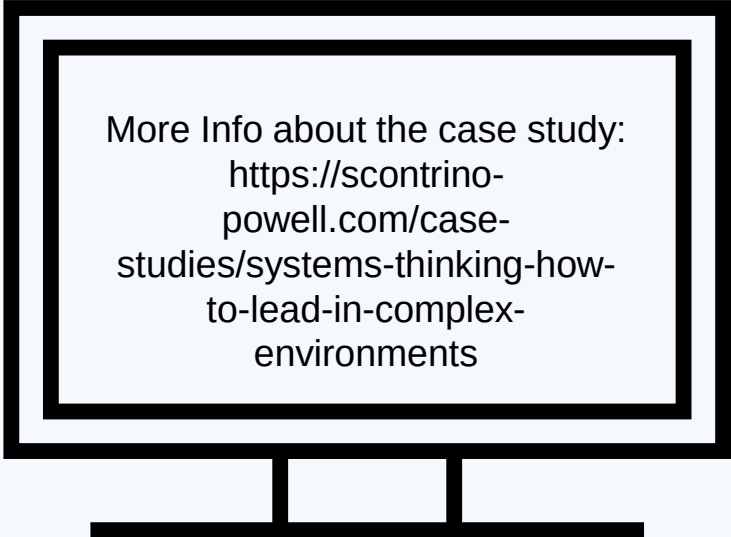
They looked at employee survey results, conducted exit interviews, and examined work processes in the departments that had the highest turnover. Their hard work was soon rewarded as they came to identify a number of factors that seemed to be contributing to turnover:

- A competing firm nearby had been actively recruiting their sales staff and offering higher pay.
- Work teams in two departments had become intensely siloed, making it difficult to accomplish tasks.
- It also turned out that the leadership team's initiatives (many of which were Sue's) were adding greater workload and leading to stress and burnout, particularly in the siloed departments.

### 3. PRACTICAL REAL CASE

#### A CASE STUDY FROM SCONTRINO-POWELL ( [HTTPS://SCONTRINO-POWELL.COM](https://scontrino-powell.com) )

“Although Sue could not offer her staff more pay or convince the competing firm to stop recruiting her salespeople, she was able to increase intergroup collaboration by arranging the office to bring teams physically closer, creating a few shared “water-cooler” locations, and establishing an online forum for teams to request and share information. Finally, after learning about “initiative fatigue” through a conversation with her executive coach, she decided that the unintentional outcomes (stress, burnout, and revenue loss associated with turnover) were causing more harm than the boosts in productivity or morale purported by many of her initiatives. As a result, turnover dropped slowly but steadily over the next year to a respectable 10%.”



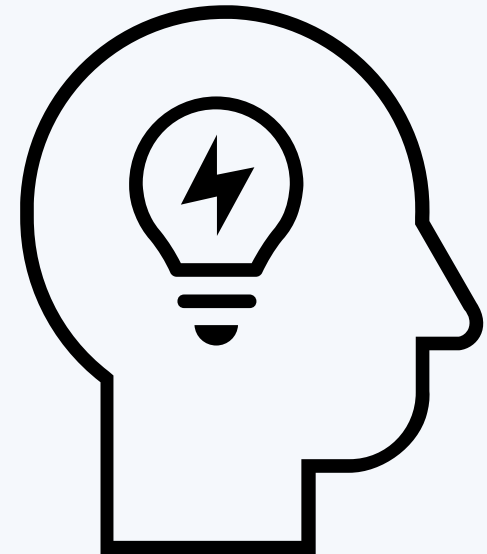
More Info about the case study:  
<https://scontrino-powell.com/case-studies/systems-thinking-how-to-lead-in-complex-environments>

### 3. PRACTICAL REAL CASE

#### A CASE STUDY FROM SCONTRINO-POWELL ( [HTTPS://SCONTRINO-POWELL.COM](https://scontrino-powell.com) )

With the help of the case study it could be underlined that systems thinking has the following characteristics:

- A firm and strong commitment to learning.
- A ready willingness to challenge one's own mind model - to accept one's own role in problems and to be open to other ways of seeing and acting.
- Always include multiple perspectives when considering a phenomenon - "triangulating" the perspectives of customers, employees, experts, etc.



## 4. CONCLUSIONS

### WHAT DID WE LEARN FROM THIS UNIT?

#### Our Knowledges

Understanding the benefits of effectively applying Systems Thinking.

Understanding the basic concepts of Systems Thinking and relating them with each other.

Understanding the benefits of Systems Thinking in digital world and in a constantly changing ecosystem.

Understanding the positive impact of systems thinking on the effectiveness of digital transformation.

Understanding the collaboration between the Systems Thinking, digital transformation and bionic companies.

Being aware of the different business models and companies, which apply Systems Thinking approach.

Understanding the bionic companies and their approach to Systems Thinking

#### Our Skills

Applying successful Systems Thinking approach.

Identifying the concepts related with systems thinking.

Identifying patterns and relationships between systems thinking and digital transformation.

Combining technological and human capabilities in order to approach Systems Thinking in digital world.

#### Our Competences

Autonomous ability to carry out systematic analysis.

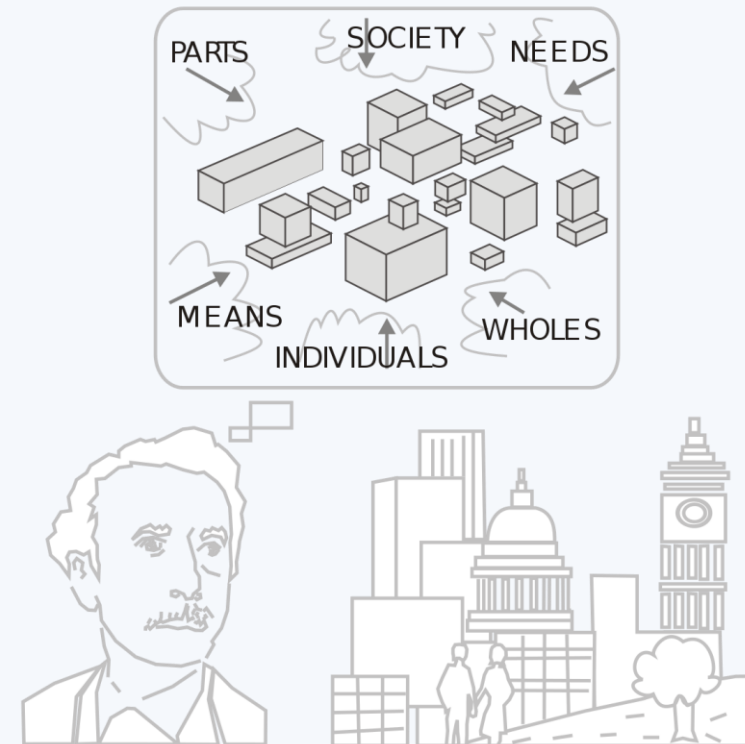
## 4. CONCLUSIONS

### WHAT DID WE LEARN FROM THIS UNIT?

#### LAST BUT NOT LEAST

Systems thinking provides a framework for understanding the problem and situation, its reason, and the approach to solving it. The application of systems thinking enables the right project and method to be undertaken in the right way to develop the right solution to the right problem.

Systems Thinking helps plan for and control complexity and uncertainty by involving flexibility into consulting activities. It can compensate for the weaknesses of existing frameworks and provide a more general framework that includes both prescriptive and descriptive elements.



Source:

[https://upload.wikimedia.org/wikipedia/commons/thumb/9/90/Systems\\_thinking\\_about\\_the\\_society.svg/1200px-Systems\\_thinking\\_about\\_the\\_society.svg.png](https://upload.wikimedia.org/wikipedia/commons/thumb/9/90/Systems_thinking_about_the_society.svg/1200px-Systems_thinking_about_the_society.svg.png)



## ADDITIONAL READINGS

### INTERESTING AND COMPLEMENTARY ARTICLES/PAPERS/VIDEOS ABOUT SYSTEM THINKING:

- 2015 Conference on Systems Engineering Research; A Definition of Systems Thinking: A Systems Approach from Ross D. Arnold, Jon P. Wade Stevens Institute, Castle Point on Hudson, Hoboken, NJ 07030,USA. Online available as a PDF on website: <https://reader.elsevier.com/reader/sd/pii/S1877050915002860?token=C3C09984856119C632E12C5A59AD53B1E5597617BF04102F1128EC1BCFDECFE3275450E4B6396EDACB814F1112A96CA5&originRegion=eu-west-1&originCreation=20220313164056>
- Systems Thinking — What is it all about? from Gian Wieck, Feb 5 2021, Online available as a PDF on website: <https://medium.com/systemic-design-group/systems-thinking-what-is-it-all-about-1e5135de97b3>
- Leyla Acaroglu, “Tools for Systems Thinkers: The 6 Fundamental Concepts of Systems Thinking”, 07.09.2019 Online available as a PDF on website: <https://medium.com/disruptive-design/tools-for-systems-thinkers-the-6-fundamental-concepts-of-systems-thinking-379cdac3dc6a>
- A website, which contains access links to introductory pieces and courses about Systems Thinking: <https://learningforsustainability.net/systems-thinking/>
- The Iceberg Model for Systems Thinkers: <https://youtu.be/9I5YvLm5KXI>
- Systems Thinking!: [https://youtu.be/GPW0j2Bo\\_eY](https://youtu.be/GPW0j2Bo_eY)

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- [9] Logan Derrick "5 Advantages of Systems Thinking and How to Make Full Use of It" September 19, 2019 [Online]. Available: <https://toggl.com/blog/5-advantages-of-systems-thinking>

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- [11] S. S. a. A. M. Erdelina Kurti, 03 12 2021. [Online]. Available: <https://www.google.com.tr/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjZz9iMP2AhVRQvEDHYEyCekQFnoECAoQAQ&url=https%3A%2F%2Fwww.mdpi.com%2F2079-8954%2F9%2F4%2F86%2Fpdf&usg=AOvVaw3Py4hHWF7A9Tr-a49m3Tp>.
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# Fostering diGitalisation and blonic transformation of SMEs through the development of a novel and innovative Training material for overcoming COVID-19 crisis

[HTTPS://GIST-PROJECT.EU/](https://gist-project.eu/)



**Thank  
you**

# TU.3 LU.12

**TRAINING UNIT 3 - BT MANAGEMENT**

**LEARNING UNIT 12 - BIONIC TRANSFORMATION SUPPORT ENVIRONMENT**

Your Text Here



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This project has been funded with support from the European Commission (Ref: 2020-1-DE02-KA226-008154).

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## **1. BIONIC TRANSFORMATION SUPPORT ENVIRONMENT LEARNING OUTCOMES**

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### **2.1. Introduction and big Why**

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### **3.2. Innovation centers**

### **3.3. Science and technology parks**

### **3.4. Accelerators**

### **3.5. Soft-landing missions**

### **3.6. Startup Consultancies**

### **3.7. Government agencies**

### **3.8. Industry clusters**

### **3.9. Universities**

## **4. MATCHING YOUR NEEDS WITH SUPPORT INSTITUTIONS**

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### **4.2. Business growth stage**

### **4.3. Business maturity stage**

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## **8. CONCLUSIONS**



# 1. BIONIC TRANSFORMATION SUPPORT ENVIRONMENT LEARNING OUTCOMES



Bionic transformation support organizations are nonprofit, public or for-profit resource organizations that serve local businesses and support their growth and innovation and form the business support environment.

At the end of this module, you will know the types of business support organizations and the services and benefits they can provide to businesses. You will get to know which data sources can be used to map the existing BSOs in their region that can help to achieve the bionic transformation (e.g., incubators, technology parks, university centres, specialised agencies for supporting businesses, helpdesks etc.). Once this is known, you will be able to tap into resources in your region or country in order to source information, practical assistance or trust and connections.

## 2. INTRODUCTION TO BIONIC TRANSFORMATION SUPPORT ENVIRONMENT

### 2.1. INTRODUCTION AND BIG WHY

Today, when accelerating technology development and digital transformation as part of our daily lives, companies also disrupt the old ways of doing business, invent new approaches to ongoing problems and offer consumers previously unseen products and services. In other words, companies are undergoing ever increasing bionic transformation.

Why companies seek backup from various groups and organizations? The reason is that the access to all kinds of support and resources can play an essential role in a success of such transformation, it is quite natural for the.



*Towards bionic transformation. Source: Boston Consulting Group*

## 2. INTRODUCTION TO BIONIC TRANSFORMATION SUPPORT ENVIRONMENT

### 2.1. INTRODUCTION AND BIG WHY

The support for companies can come in different forms, from simply being part of a like-minded community, which allows you to share experiences with other people and get guidance from mentors and high-qualified experts, to receiving actual financial investments.

Naturally, a truly developed and nurturing support environment is formed by many organizations and business entities, both public and private. For companies, especially at their start-up phase, all this diversity of infrastructure is exciting but also confusing. The abundance of institutions and supporting platforms makes it difficult to tell them apart and decide which one is more suitable for the specific needs of a company and at what stage of the business it is best to utilise them.

With this in mind, let's look at various enabling platforms and structures that help companies to succeed and flourish.

**IN THE END OF THE DAY, TRANSFORMATION DOES NOT HAPPEN IN VACUUM. IT REQUIRES EFFORT OF MANY.**

### 3. OVERVIEW OF SUPPORT INSTITUTIONS



First, let's list all the main entrepreneur-enabling platforms and business vehicles that are considered to be a part of the business support ecosystem nowadays. They support companies through their services, financing, their ability to create a network and through other means of support. They include:

- Incubators
- Accelerators
- Innovation Centers
- Soft-Landing Missions
- Government Agencies
- Science and Technology parks
- Specialized Consultancies
- Universities and research centers
- Trade promotion agencies / Chambers of Commerce
- Clusters
- Industry associations

Now we will review each of these organization types, looking at their business models, distinctive features, advantages and limitations

## 3. OVERVIEW OF SUPPORT INSTITUTIONS

### 3.1. INCUBATORS

**INCUBATORS ARE ORGANIZATIONS HELPING EARLY-STAGE STARTUP FOUNDERS TO DEVELOP IDEAS AND PROPER STRATEGY FOR LONG-TERM GROWTH, PROVIDING SUPPORT, TRAINING AND OFFICE SPACE**

- Support from idea generation to start-up establishment
- Fee-based
- Select members based on a number of criteria
- Provide office space for startups
- Support companies with training, mentoring, peer-learning

#### **ADVANTAGES**

Allow to save on office rent

Networking

Focus on long-term growth at your chosen place

#### **LIMITATIONS**

Participation fees and other charges

Your company has to be selected through an application process

Limited expert help

Your Text Here

## 3. OVERVIEW OF SUPPORT INSTITUTIONS

### 3.2. INNOVATION CENTERS

**INNOVATION CENTERS ARE CREATIVE SPACES TO SHARE KNOWLEDGE AND NURTURE IDEAS IN A SINGLE LOCATION WITH A CLUSTER-LIKE ENVIRONMENT.**

- Target innovative start-ups
- Develop and test ideas
- Collaborative and co-creative environments
- Access to research and innovation infrastructure
- Funding via grants, vouchers and contests

#### **ADVANTAGES**

Provide access to local innovation ecosystem  
(government, industry, peers)

Support startups with both business and research  
capacity

Grant funding opportunities supporting your R&D  
objectives

#### **LIMITATIONS**

Fee or rent/based partnership

Locally-oriented, limited international reach

Broad focus, limited domain-specific support

Less attention to business acceleration

## 3. OVERVIEW OF SUPPORT INSTITUTIONS

### 3.3. SCIENCE AND TECHNOLOGY PARKS

**SCIENCE AND TECHNOLOGY PARKS ARE ORGANIZED INDUSTRIAL COMPLEXES, WHOSE PRIMARY FUNCTION IS TO SUPPORT BUSINESSES THAT OPERATE IN INNOVATIVE SECTORS AND OFFER HI-TECH PRODUCTS AND SERVICES**

- Target established innovation and technology-oriented businesses
- Offer link to educational or research centers or other institutions in the educational field
- Offer intellectual property rights support
- Perform a technology transfer function
- Has a team of experts able to make the technological transfer to the business and production area
- Provide premises as well as access to technical infrastructure

#### ADVANTAGES

Often focus on a specific sector (e.g., biotech, information technology)

Provide access to technical infrastructure (e.g., labs)

#### LIMITATIONS

Fee or rent/based partnership

Less focus on soft services

Your Text Here



## 3. OVERVIEW OF SUPPORT INSTITUTIONS

### 3.4. ACCELERATORS

**ACCELERATORS ARE PROGRAMS SUPPORTING STARTUPS WITH EDUCATIONAL CONTENT AND FUNDING OPPORTUNITIES TO SECURE QUICK GROWTH.**

- Provide intense short-term cooperation
- Cohort-based (organized according to a syllabus and taken by a group of startups)
- Select numbers based on a few criteria
- Training, mentoring, peer-learning, social activities
- Pitch and demo events

#### **ADVANTAGES**

Help achieve quick growth starting from fundraising stage

Exposure to potential customers and investors

A way to benchmark your company with others

#### **LIMITATIONS**

Accelerators' syllabus don't match individual company needs

A digital startup gets more opportunities for fast scaling than a hardware one

Selective process with pre-determined application periods

Fees or charges

### 3. OVERVIEW OF SUPPORT INSTITUTIONS

#### 3.5. SOFT-LANDING MISSIONS

**SOFT-LANDING MISSIONS ARE TYPICALLY SHORT (1 WEEK) AND INTENSIVE PROGRAMS DESIGNED TO HELP STARTUPS TO DISCOVER NEW MARKETS AND SCALE-UP ABROAD**

- Help assess market potential for companies, incl. Startups
- Information on legal, economic and cultural context of a new business area
- Explore competitive landscapes
- Gather business intelligence
- Discover customers and establish partnerships

##### **ADVANTAGES**

Business development with local expert guidance

No need to establish a local branch

Real business intelligence and interaction

Allow companies to test first traction to justify bigger internationalization effort

##### **LIMITATIONS**

Costs

Work and time-intensive experience

Requires high preparedness level (better for companies at mature stages)

Your Text Here

## 3. OVERVIEW OF SUPPORT INSTITUTIONS

### 3.6. STARTUP CONSULTANCIES

**STARTUP CONSULTANCIES ARE SPECIALIZED COMPANIES FOCUSED ON ASSISTING STARTUPS WITH TECHNOLOGY SCOUTING, GATHERING EVIDENCE, BUILDING STRATEGIC PARTNERSHIPS AND OTHER ASPECTS OF STARTUP ACCELERATION.**

- Hands-on assistance with challenges specific to your business
- Executive expertise and extensive network of contacts
- Flexibility in business model for early-stage clients
- Adjustment to the startup's timing and needs
- Insights into trends and practices

#### **ADVANTAGES**

Flexible expertise and capacity in line with company's business planning and needs

Possibility to choose a partners based on individual criteria

More actionable and controlled approach compared to other programs

#### **LIMITATIONS**

Understanding your business goals and clear formulations of your needs is required

Sourcing can be time-consuming

Costs

Your Text Here

## 3. OVERVIEW OF SUPPORT INSTITUTIONS

### 3.7. GOVERNMENT AGENCIES

**GOVERNMENT AGENCIES ARE ENTITIES FORMED BY THE GOVERNMENT OF ANY LEVEL WITH A GOAL TO PROVIDE PRIVATE STARTUPS WITH SUPPORT AND ASSISTANCE**

- Grant programs
- Mentoring, incubation and acceleration programs
- Trade shows and other international support

#### **ADVANTAGES**

Contact network access

Country-wide presence through regional offices

#### **LIMITATIONS**

Formal and administrative requirements

Domain-agnostic

Your Text Here

## 3. OVERVIEW OF SUPPORT INSTITUTIONS

### 3.8. INDUSTRY CLUSTERS

CLUSTER ARE GEOGRAPHIC CONCENTRATION OF INTERCONNECTED FIRMS, SUPPLIERS, AND INSTITUTIONS IN A PARTICULAR FIELD WHO COOPERATE AS WELL AS COMPETE

- Share a common market
- Facilitate the exchange of suppliers
- Develop localized worker skills and know-how

#### ADVANTAGES

Increased Productivity

Specialized Workers

Rapid Innovation

Faster growth, recognition, and status within the market

#### LIMITATIONS

Often export-oriented products

Ability to coordinate efforts and financial resources to create new products and technologies is required

Your Text Here

## 3. OVERVIEW OF SUPPORT INSTITUTIONS

### 3.9. UNIVERSITIES

UNIVERSITIES ARE KEY PLAYERS IN THE SUPPORT SYSTEM FOR ENTREPRENEURSHIP AND INNOVATION.

- Entrepreneurship education
- Technology transfer and university spin-offs
- Develop localized worker skills and know-how

#### ADVANTAGES

Offer entrepreneurship studies, courses on management and innovation, digital marketing, etc  
Encourage experimentation  
Access to specific know-how and expertise

#### LIMITATIONS

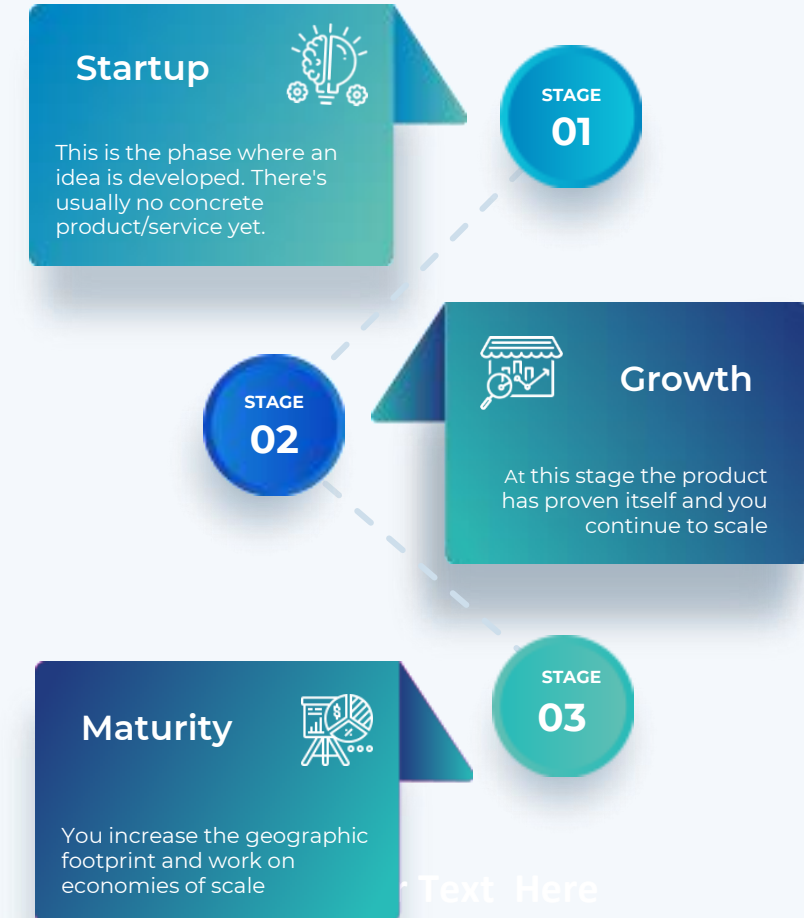
Less attention to commercialization

## 4. MATCHING YOUR NEEDS WITH SUPPORT INSTITUTIONS

Now, let's look at which of these platforms and support channels will be the most appropriate to utilise when facing major challenges in your bionic transformation journey.

A list of business support organizations (BSOs) and their respective service offerings depend on three stages of the business life cycle:

- **Start-up** - During this stage, your main priority is to find and obtain customers, develop a product or service, and build a brand identity.
- **Growth** - When you know exactly what your business model is, and your customers do, too.
- **Maturity** - Marked by yearly growth and a solid core of employees, your business has an established presence in its market.





## 4. MATCHING YOUR NEEDS WITH SUPPORT INSTITUTIONS

### 4.1. BUSINESS START-UP STAGE



**Very relevant is business planning.**

**You will also be looking for soft support, physical infrastructure and funding .**

#### **Incubators**

Using an incubator can be beneficial as a way to expose your startup to feedback, be in a focused environment and for peer learning.

#### **Mentorships**

Helps to avoid dead ends and ineffective steps, involve seasoned professionals who have been through the same journey already to guide your effort.

#### **Innovation centers**

Innovation centers are perfect to access technologies and facilities that can help you to prototype and build first evidence for your product.

#### **Government agencies**

The role of local or regional authority in this phase is crucial as a facilitator of entrepreneurial culture and opportunities for budding entrepreneurs

STAGE 02 Growth

## 4. MATCHING YOUR NEEDS WITH SUPPORT INSTITUTIONS

### 4.2. BUSINESS GROWTH STAGE



Growth

**STAGE**  
You are generating first revenue and growing by reinvesting the money into conquering the market. It's time to think about a growth strategy, whether you scale exponentially or incrementally

#### **Incubators**

At this stage you the soft support service are essential. You also will be needing administrative support to set the bases for the fiscal and financial management. These are the services offered by incubators.

#### **Universities**

Universities could have a strategic role, but in general, except some technical departments, it is necessary for them to be closer to market

#### **Government agencies**

**STAGE**

The role of local or regional authority in this phase is related with the support offered by National Investment agencies, Vocational Education authorities, Employment Agencies

#### **Trade or industry associations**

But also Chambers of commerce, export promotion agencies provide sectoral expertise and possibility to organize participation in fairs

## 4. MATCHING YOUR NEEDS WITH SUPPORT INSTITUTIONS

### 4.3. BUSINESS MATURITY STAGE



**You are expanding your businesses to new markets or in innovative ways.**  
**R&D cooperation, knowledge transfer and internationalization may be particularly important in times of transition or decline.**

#### **Industrial Parks, Technological Parks, Innovation Centers**

for strong network linkages. At this stage they must be flexible and very market oriented, with a focus on attracting specific industries/sectors.

#### **Clusters**

For the promotion of territory, in the context of regional smart specialisation strategies. They can also support cross fertilisation between mature and start ups and between different sectors

#### **Soft-landing missions**

If you're choosing international expansion but find it difficult to assess the market opportunity remotely, a soft-landing program could provide you all the necessary intelligence without major financial, legal and capacity commitment.

#### **Government agencies**

The role of local or regional authority in this phase is related with the support offered by National Investment agencies, Vocational Education authorities, Employment Agencies

# 4. MATCHING YOUR NEEDS WITH SUPPORT INSTITUTIONS

## 4.4. COMPARISON BETWEEN SUPPORT INSTITUTIONS

|                                     | Incubator<br>s | Accelerat<br>ors | Innovatio<br>n centers | Soft-<br>landing<br>missions | Startup<br>consultan<br>cies | Governm<br>ent<br>agencies | Science<br>and<br>technolog<br>y parks | Industry<br>cluster | Universit<br>y |
|-------------------------------------|----------------|------------------|------------------------|------------------------------|------------------------------|----------------------------|----------------------------------------|---------------------|----------------|
| Fees / charges                      | ✓              | ✓                | ✓                      | ✓                            | ✓                            | ✗                          | ✓                                      | ✗                   | ✗              |
| Selective application<br>process    | ✓              | ✓                | ✗                      | ✗                            | ✗                            | ✓                          | ✓                                      | ✓                   | ✓              |
| Mentorig                            | ✓              | ✓                | ✓                      | ✓                            | ✓                            | ✓                          | ✓                                      | ✓                   | ✓              |
| Consulting and<br>advisory services | ✗              | ✗                | ✗                      | ✗                            | ✓                            | ✗                          | ✓                                      | ✗                   | ✓              |
| Peer learning                       | ✓              | ✓                | ✓                      | ✓                            | ✗                            | ✗                          | ✓                                      | ✓                   | ✗              |
| Office space                        | ✓              | ✓                | ✗                      | ✗                            | ✗                            | ✗                          | ✓                                      | ✗                   | ✗              |
| Fundraising support                 | ✗              | ✓                | ✓                      | ✗                            | ✓                            | ✓                          | ✗                                      | ✗                   | ✗              |
| Predefined program                  | ✗              | ✓                | ✗                      | ✓                            | ✗                            | ✓                          | ✗                                      | ✗                   | ✓              |
| International market<br>reach       | ✗              | ✓                | ✗                      | ✓                            | ✗                            | ✓                          | ✗                                      | ✗                   | ✓              |

## 4. MATCHING YOUR NEEDS WITH SUPPORT INSTITUTIONS

### 4.5. CONCLUSIONS

The business support ecosystem should support the whole process from the entry of possible entrepreneurs to the continuous support during the lifecycle stages of enterprises towards their bionic transformation.

In this context, some institutions and their services are clearly related to a specific phase (e.g., general training and networking for start up stage, or territorial promotion for mature phase), others overlap (e.g., R&D based support and Industrial & Tech park offered services for the start-up and growth stages).

A common element in every phase is the need for networking, even if with different declinations. For example, in startup stage, we see the need for specific spaces, such as co-working, where relationships are facilitated. Meanwhile, in the mature stage this need is more relevant in territorial promotion activities like clustering.

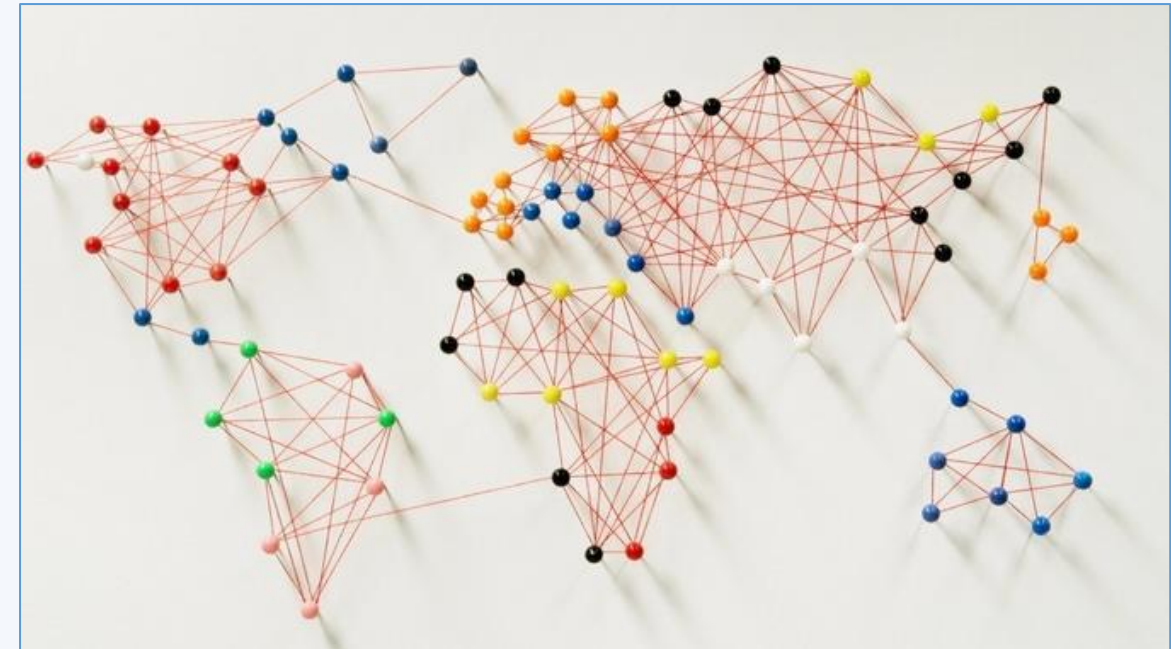
## 5. MAPPING BIONIC TRANSFORMATION SUPPORT ENVIRONMENT

### 5.1. INTRODUCTION

As we have seen, there are many organizations that support the ongoing growth of entrepreneurs and businesses in your region or in your country. Moreover, some have value on specific stages of your company development. Looking into each one to discern their potential value could be time-consuming and tedious.

But now that you know the types of supporting organizations and what they can offer, you can take the next step and map actors which can help you with your needs.

Next, we provide quick guidelines on how to map the support environment that can help the companies and facilitators of bionic transformation to use the existing support structure to achieve the transformation (from incubators, technology parks, university centres, specialised agencies for supporting businesses, helpdesks etc.).



*Mapping of complex concepts.. Source: Shutterstock*

Your Text Here

# 5. MAPPING BIONIC TRANSFORMATION SUPPORT ENVIRONMENT

## 5.2. QUICK GUIDE



- You can't do your business alone. Think of getting help from the community.
- Identify who are the actors around that can help with resources or information.

- First, refine your context according to your interest:
  - Geographical focus: you can map a specific region or even a city.
  - Sector-specific focus: e.g ICT or agriculture.
  - Thematic focus: you can also choose to focus the mapping on a topic; examples are green and inclusive business or women entrepreneurship.

- Here are quick tips when to look for information:
  - Do your research on the internet
  - Go to your local public authority (department of economics or similar) or Regional development agency – they will likely have most of the names for you.
  - Go to your local Chamber of Commerce for everything on trade and export.
  - Go to industry organizations if you are searching for peer advice.
  - Check the directory of some key support organizations in Germany, Slovenia, Croatia, Spain, Poland and Belgium (*check slides 36 – 46 for hints*)



## 5. MAPPING BIONIC TRANSFORMATION SUPPORT ENVIRONMENT

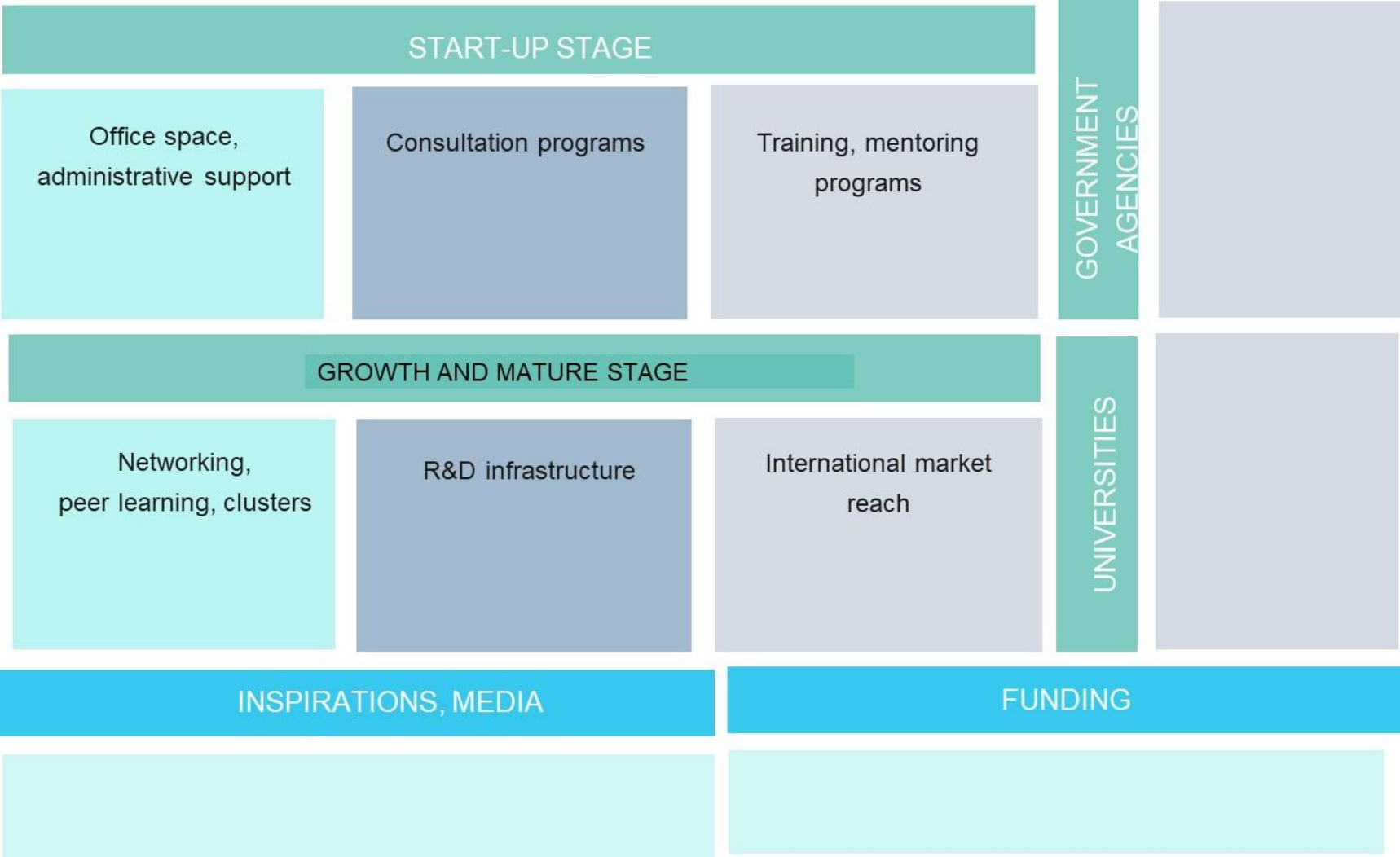
### 5.2. QUICK GUIDE



- Open contributions from your local community. Release early version of the list on local media, mailing list, Facebook groups to get feedback.
- Got a huge list of names? Narrow down!
- Figure out which of these agencies (whether there are dozens or thousands of them in your community) would be likely to support your organization on particular stage of your development
- Check *slide 17* for three stages of growth of business.
- There is no one right way to organize your results, do it as you like, if the result is useful for you.
- **On next page we offer a simple basic framework for you to map the institutions in your community that can help you on your transformation journey.**

# 5. MAPPING BIONIC TRANSFORMATION SUPPORT ENVIRONMENT

## 5.3. TEMPLATE



# 5. MAPPING BIONIC TRANSFORMATION SUPPORT ENVIRONMENT

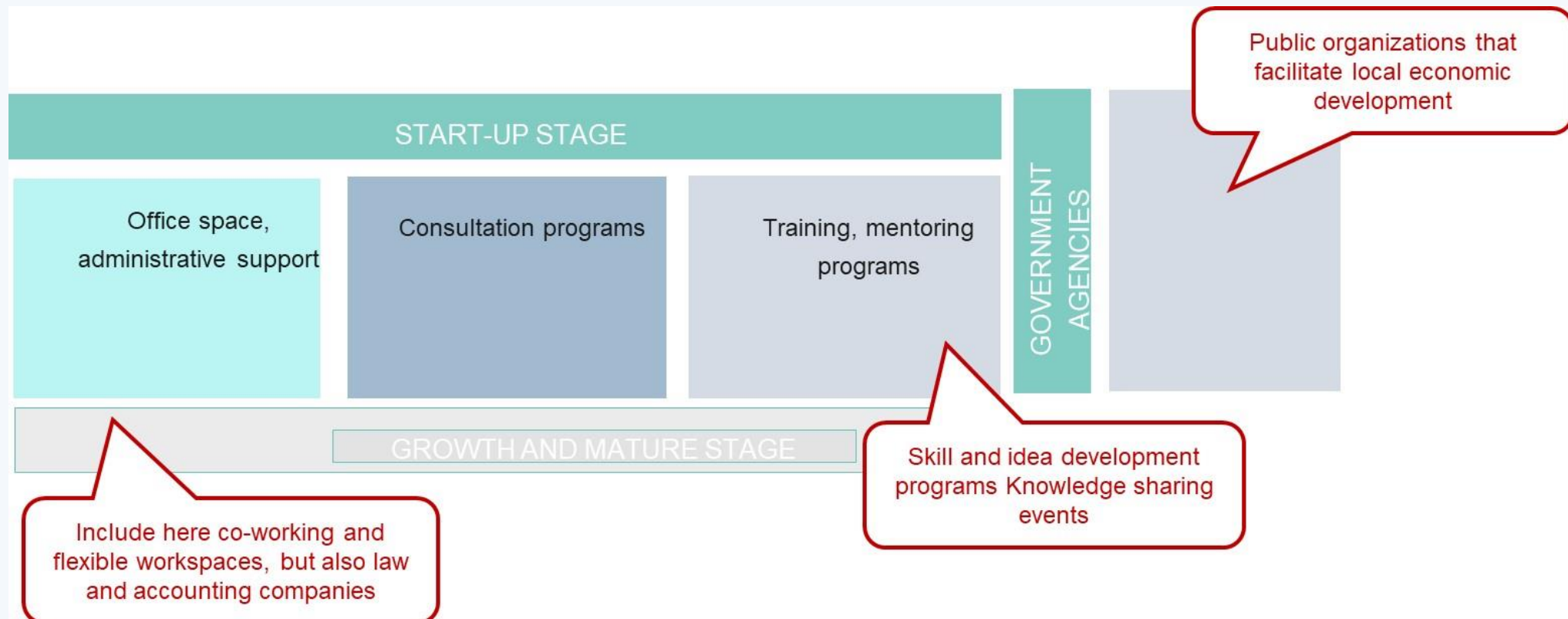
## 5.3. TEMPLATE

There is no one right way to organize your results, do it as you like, if the result is useful for you.

Here is a simple basic framework for you to map the institutions in your community that can help you on your transformation journey.

Start in the upper part if you are on a start-up stage.

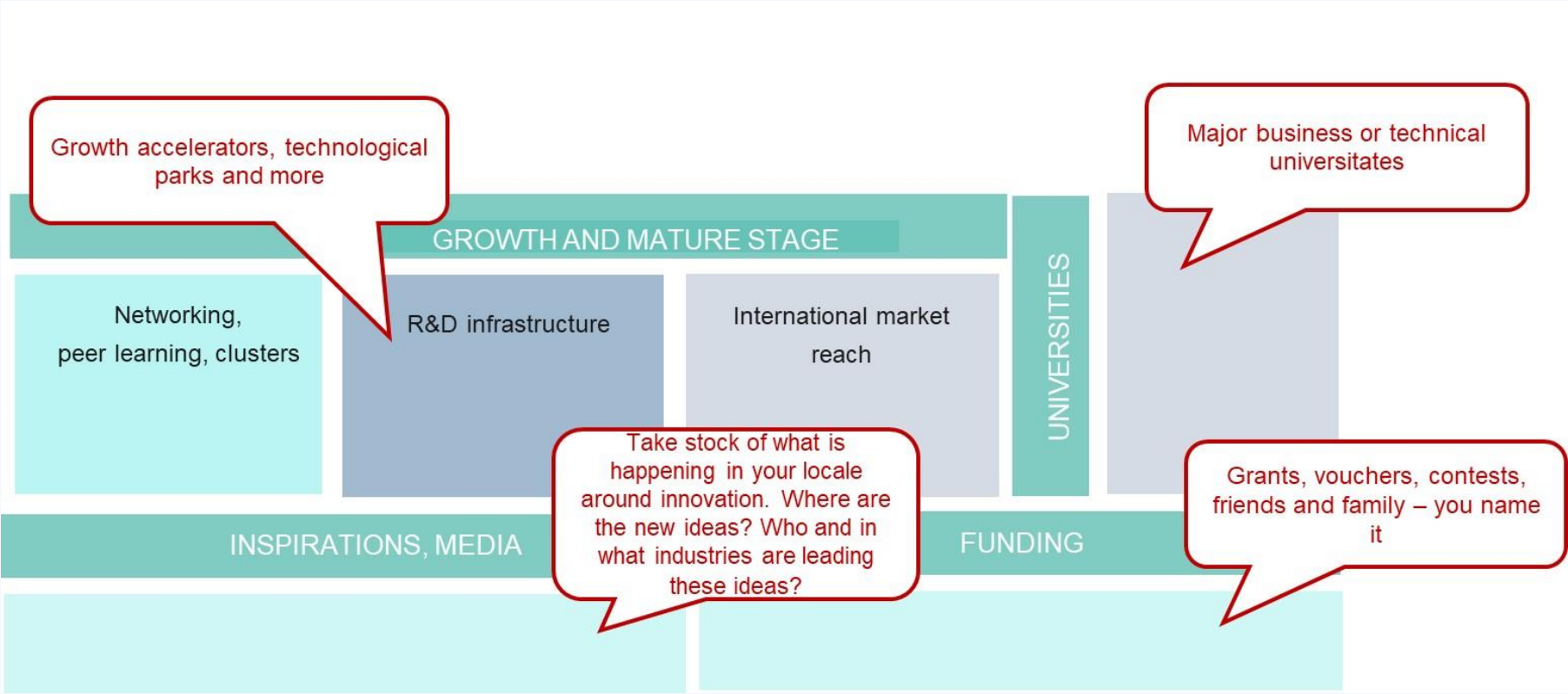
List the support organizations you have produced in each of the blocks.



# 5. MAPPING BIONIC TRANSFORMATION SUPPORT ENVIRONMENT

## 5.3. TEMPLATE

Continue the lower part if you are well-established business.  
 List the support organizations you have produced in each of the blocks



In the end, you should be able to get a one-page list of institutions that you believe, with proper cultivation and a good case, would support your organization. Now go out there out and get them!

## 6. SUPPORT ORGANIZATIONS AT THE EU LEVEL

### 6.1. OVERALL EU FRAMEWORK PROGRAMS

Business support organizations are not only organized through national governments, private organizations and associations. The European Union itself supports the internationalization process of EU SMEs by financing and or running dedicated support organizations.

Two of the most important and largest general programmes available for EU SMEs are the Your Europe Business Portal and the Enterprise Europe Network (EEN). The Enterprise Europe Network (EEN) is the largest network of business and innovation support organizations for the benefit of EU SMEs. Even though, a large share of the EEN services are tailored towards supporting EU SMEs growing their business in the EU and allowing them to benefit from EU legislation, funding opportunities and EU programmes, there are also specific services for entering third country markets. The Going International service has been specifically designed for realising gains in nondomestic markets using, among others, matchmaking events.

The EEN can also rely on a large network of contact points in third countries to help EU SMEs expand into these markets. The EEN operates through business support organizations in approximately 50 countries.

## 6. SUPPORT ORGANIZATIONS AT THE EU LEVEL

### 6.1. OVERALL EU FRAMEWORK PROGRAMS

Secondly, the European Commission manages the Your Europe Business Portal and the European Small Business Portal, which both contain a large and comprehensive amount of information for all European SMEs. Both portals are broad in nature, which implies that they offer information on support services available in the EU in all types of areas, from rules and regulations to environment to expanding business abroad.

Moreover, the EC offers a variety of online services specifically focused on trading issues, which make these services especially relevant for SMEs wishing to internationalise. The online databases 34 Study on Support Services for SMEs in International Business and websites contain information about import conditions in non-EU markets (Market Access Database), tariffs (Online customs tariff database), technical barriers to trade in non-EU countries (Technical Barriers to Trade (Enquiry Point)) and taxation issues (European Customs Information Portal).

Lastly, another large general SME support organisation is EUREKA, which manages the Eurostars programme. This is an EU programme that offers financial support, but specifically target SMEs in Europe( that devote 10% of their turnover or total FTEs to research) with funding for international research. It focuses on the development of new products and access to markets.

## 6. SUPPORT ORGANIZATIONS AT THE EU LEVEL

### 6.2. FINANCIAL SERVICES

A few EU wide institutions focus on providing financial support to EU SMEs. The European Bank for Reconstruction and Development (EBRD), for example, manages an SME Finance Facility for SMEs in Eastern European member states. The programme amounts to €847 million (with 130 million Euro financed by the EC), which is channelled to EU SMEs through partner banks. Hence, SMEs cannot apply directly at the EBRD for funding.

Next to the financial support, the EBRD also manages two non-financial support programmes: the Turn Around Management Programme and the Business Advisory Services programme.

The European Investment Bank (EIB) offers two different financing programmes. The first is the JEREMIE programme, which offers indirect support through national and regional authorities. This support contains, for example, guarantees, micro-loans, credit insurance and funds. The second programme is Loans for SMEs, which are loans offered via partner banks to EU SMEs.

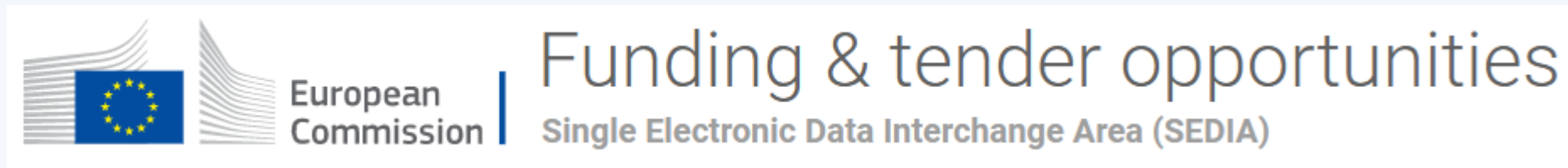


## 6. SUPPORT ORGANIZATIONS AT THE EU LEVEL

### 6.3. FUNDING AND TENDER OPPORTUNITIES PORTAL

To find a suitable call for proposal, the European Commission and its funding bodies publish calls for proposals on the Funding & Tenders Portal, the single point of entry for all EU funding and tenders, i.e., grants, prizes and procurements managed by the European Commission and other EU services.

This tool aims to help organizations find and apply for suitable EU funding and tender opportunities.



*SEDIA. Source: EC Website*

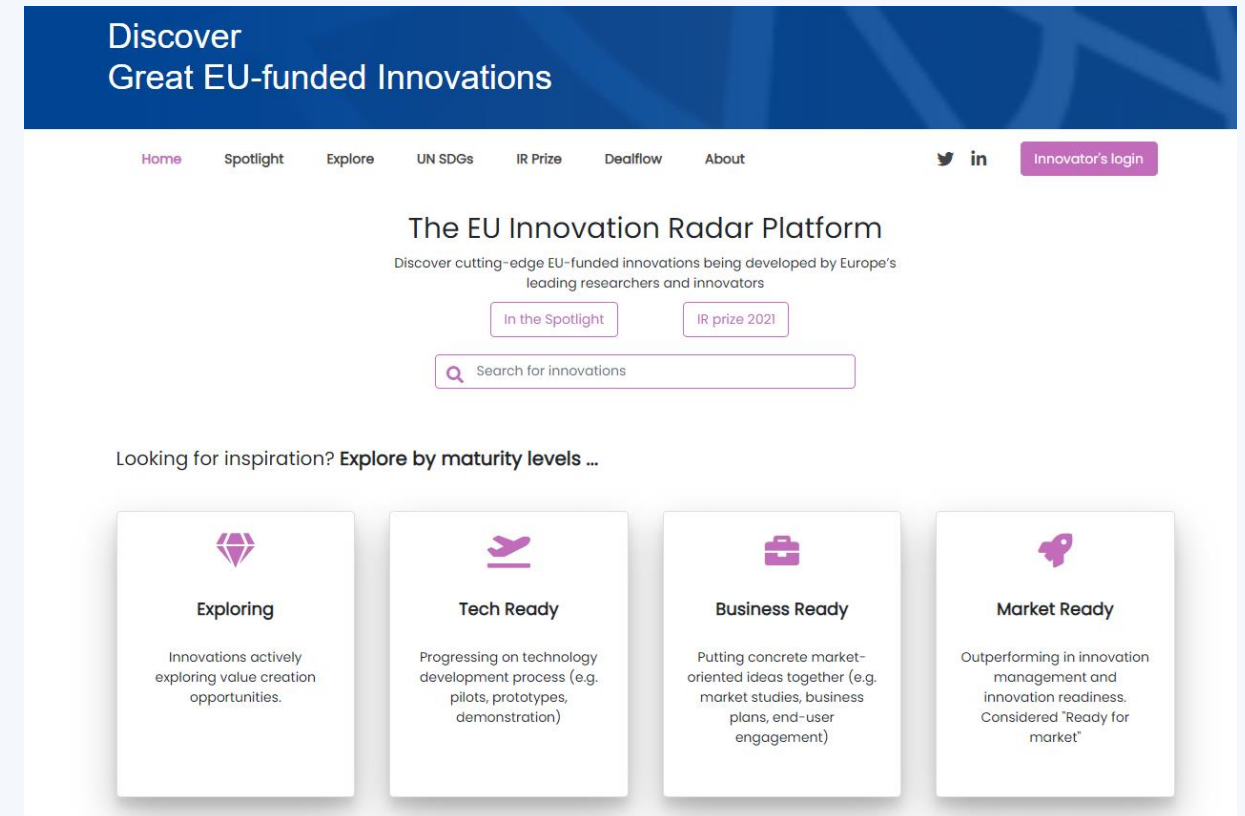
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## 6. SUPPORT ORGANIZATIONS AT THE EU LEVEL

### 6.4. EU SPONSORED NETWORK INITIATIVES

Among the EU sponsored cluster and network initiatives, the European Business & Innovation Centre network is among the largest and most important. It offers various business incubation services to EU SMEs wishing to internationalise, such as the soft-landing club.

The Innovation Radar is the European Commission's data-driven initiative to identify high potential innovations and innovators in EU-funded research and innovation projects. Its goal is to allow every citizen, public official, professional and businessperson to discover the outputs of EU innovation funding.



The innovation Radar. Source: InnoRadar website

## 6. SUPPORT ORGANIZATIONS AT THE EU LEVEL

### 6.4. EU SPONSORED NETWORK INITIATIVES

Startup Europe is an initiative of the European Commission to connect high tech startups, scaleups, investors, accelerators, corporate networks, universities and the media. It is supported by a portfolio of EU funded projects and policy actions such as the EU Startup Nation Standard, Innovation Radar and the Digital Innovation and Scale-up Initiative (DISC).

The European Institute of Innovation & Technology (EIT) The EIT is an independent body of the European Union set up in 2008 to boost innovation and entrepreneurship across Europe. The EIT's main instrument is the Knowledge and Innovation Communities (KICs) model. The KICs are expected to boost entrepreneurship and support the emergence of new companies in their thematic areas, which relate to societal challenges such as Climate, Digital or Urban Mobility. The KICs are public-private partnerships with significant industrial participation and are currently co-funded by the EU's Horizon 2020 programme. Their programmes all offer a typical range of accelerator services, including coaching, business planning and investment readiness for a duration of about 12 to 24 months.

## 7. EXAMPLES OF BUSINESS SUPPORT ORGANIZATIONS IN PROJECT PARTNER COUNTRIES



Here are some resources for you to tap into:

- Poland startup list resource List: 95+ Accelerators, Incubators, Investors, and more <https://fi.co/insight/infographic-of-200-startup-resources-in-warsaw>
- Updated List of 250+ Startup Resources in Croatia <https://fi.co/insight/updated-list-of-200-startup-resources-in-croatia>
- Brussels Startup Resources: A List of 150+ Investors, Accelerators, and Tech Events <https://fi.co/insight/a-list-of-150-startup-resources-in-brussels-input-needed>

## 7. EXAMPLES OF BUSINESS SUPPORT ORGANIZATIONS IN PROJECT PARTNER COUNTRIES

### GERMANY

Here are some resources for you to tap into.

#### Chambers of Commerce

IHK Akademie Schwaben [www.ihk-akademie-schwaben.de](http://www.ihk-akademie-schwaben.de)

#### Technology parks

Technopark Kamen <https://technopark-kamen.de>

Technologiepark Ostfalen [www.tpo.de](http://www.tpo.de)

Berlin Adlershof science and technology park [www.adlershof.de](http://www.adlershof.de)

#### Industry Associations

Main Association of the German Wood Industry [www.holzindustrie.de](http://www.holzindustrie.de)

#### Clusters

BioEconomy Cluster Central Germany [www.bioeconomy.de](http://www.bioeconomy.de)

BioRN - Life Science Cluster Rhine-Neckar [www.biorn.org](http://www.biorn.org)

Cluster New Materials [www.bayern-innovativ.de](http://www.bayern-innovativ.de)

## 7. EXAMPLES OF BUSINESS SUPPORT ORGANIZATIONS IN PROJECT PARTNER COUNTRIES

### GERMANY

#### Research institutions

Fraunhofer Institute for Production Technology IPT [www.ipt.fraunhofer.de/en/Profile/cooperation.html](http://www.ipt.fraunhofer.de/en/Profile/cooperation.html)

Thünen Institute for Wood Research [www.thuenen.de/en/institutes/wood-research](http://www.thuenen.de/en/institutes/wood-research)

Fraunhofer-Institute for Wood Research - Wilhelm-Klauditz-Institute [www.wki.fraunhofer.de/en.html](http://www.wki.fraunhofer.de/en.html)

Institute for Man-Machine Interaction [www.mmi.rwth-aachen.de/en/#inner-content](http://www.mmi.rwth-aachen.de/en/#inner-content)

#### Science parks

SmartFactoryOWL <https://smartfactory-owl.de>

CIIT EV - CENTRUM INDUSTRIAL <https://www.ciit-owl.de>

Potsdam Science Park <https://potsdam-sciencepark.de>

#### Incubators

EIT Climate-KIC [www.climate-kic.org/](http://www.climate-kic.org/)

## 7. EXAMPLES OF BUSINESS SUPPORT ORGANIZATIONS IN PROJECT PARTNER COUNTRIES

### SPAIN

Here are some resources for you to tap into.

#### Clusters

Innovative business association of furniture manufacturers and related in the Murcia Region <http://www.amueblacooperacion.es/en>  
The purpose of this Association is to facilitate, through the achievement of a sufficient critical mass of all the associated companies and organisations, the innovative practices to improve the competitiveness of the associated companies, defend their general business and promote their international projection and visibility. This kind of activities could be the promotion of the digital transformation of the companies

Cluster e innovation hub del equipamiento del hogar y el contract <https://www.cenfim.org/es/>  
Its activities help companies through market intelligence projects, innovation and training for change. They make it easier for professionals to meet and collaborate, both in learning environments, such as conferences and workshops, and in spaces designed for sharing, such as their meet&share. They work on innovation in the areas of digitalisation, circular economy and shared value. They lead numerous innovation projects with the participation of companies and with public funding from the EC, the state and the Autonomous Regions.

Cluster TIC Asturias <https://www.clustertic.net/> The ICT Cluster's activity is aimed at promoting the growth of the Information and Communication Technologies (ICT) sector through cooperation, exchange of experiences, training and professional specialisation in order to achieve greater participation of companies in national and international technological projects aimed at modernising traditional sectors.



## 7. EXAMPLES OF BUSINESS SUPPORT ORGANIZATIONS IN PROJECT PARTNER COUNTRIES

### SPAIN

#### Clusters

Cluster TIC Galicia <https://www.clusterticgalicia.com/>

The Galicia ICT Cluster brings together the forces of companies, business associations, professional associations and other players in Galicia's ICT macro-sector.

#### Regional Development Agencies

Regional Development Agency of the Region of Murcia <https://www.institutofomentomurcia.es/>

Economic development agency of the Autonomous Community of the Region of Murcia, which is responsible for the promotion and development of the business fabric, stimulating competitiveness, innovation and productivity of regional companies, especially SMEs.

Fundecyt-PCTEX <http://www.fundecyt.es/> FUNDECYT-PCTEX is a private, non-profit public sector foundation with a fundamental objective: the structuring of the Extremadura Science and Technology System by contributing to the socio-economic use of science and technology, supporting and promoting its development and management in order to achieve a better use of research and innovation, stimulating the participation of civil society and mobilising its resources.

Spanish Association of Regional Development Agencies <https://www.foroadr.es/> The main objective of the Spanish Association of Regional Development Agencies is to help the RDAs to provide a quality public service to companies and entrepreneurs. It is a stable framework for cooperation, started in 2001, and was formally constituted in 2007.

## 7. EXAMPLES OF BUSINESS SUPPORT ORGANIZATIONS IN PROJECT PARTNER COUNTRIES

### SPAIN

#### Educational institutions

Regional Service of Employment and Training (SEF) <http://www.sefcarm.es/>

The Regional Employment and Training Service is an autonomous body set up to carry out, with the aim of achieving full, stable and quality employment, the activities of promotion, training for employment and intermediation in the labour market, in the territorial scope of the Autonomous Community. This link will open in a new window. Its activity is aimed at making it easier for workers to obtain a decent and suitable job, favouring the promotion and retraining of workers, guaranteeing equal opportunities for men and women in employment.

#### The Digital Transformation Offices

The Digital Transformation Offices [http://www3.ciccp.es/wp-content/uploads/2020/03/Memoria2019\\_OTD.pdf](http://www3.ciccp.es/wp-content/uploads/2020/03/Memoria2019_OTD.pdf)

The Digital Transformation Offices set up throughout Spain by the Ministry of Economy and Business, through the public entity Red.es, have a global budget of five million euros which aims to improve the use, quality and access to Information and Communication Technologies (ICT).

## 7. EXAMPLES OF BUSINESS SUPPORT ORGANIZATIONS IN PROJECT PARTNER COUNTRIES

### POLAND

Here are some resources for you to tap into.

#### Investment and Trade Agencies

Polish Agency for enterprise Development / Passport to Export <https://www.parp.gov.pl/i>

UNICORN - a European Network of SME and Middle Class <http://www.unicorn-sme.org/>

Polish Agency of Enterprise Development, Department of Modern Economy Infrastructure

<https://www.parp.gov.pl/component/content/article/67535:zamkniecie-serwisow-informacyjnych-programow-operacyjnych-realizowanych-przez-parp-w-latach-2007-2013-r>

Polish Information and Foreign Investment Agency <https://www.paih.gov.pl/en>

#### Technology Centers

Center for Advanced Manufacturing Technologies <https://www.camt.pl>

Centrum Badań i Rozwoju Technologii dla Przemysłu S.A. (CBRTP) <https://www.cbrrtp.pl>

## 7. EXAMPLES OF BUSINESS SUPPORT ORGANIZATIONS IN PROJECT PARTNER COUNTRIES

### POLAND

#### Clusters

AgroBioCluster - Agri-Food and Bioeconomy Cluster AgroBioCluster <http://www.agrobioalliance.com/>  
Cluster of Business Environment Institutions <http://www.biznesklaster.pl/>  
Cluster of Innovative Manufacturing Technologies Association CINNOMATECH <http://www.cinnomatech.pl/>  
Digital Knowledge Cluster <https://knowledgecluster.pl/>

#### Technology Parks

Pomeranian Science and Technology Park <https://ppnt.pl/>  
Krakow Technology Park <https://www.kpt.krakow.pl/en/>  
Bełchatów and Kleszczów Industry and Technology Park <https://www.ppt.belchatow.pl/>  
TECHNOPARK GLIWICE <https://technopark.gliwice.pl/>  
Poznan Science and Technology Park <https://ppnt.poznan.pl/about-us/>

## 7. EXAMPLES OF BUSINESS SUPPORT ORGANIZATIONS IN PROJECT PARTNER COUNTRIES

### CROATIA

Here are some resources for you to tap into.

#### Technology Centers

Innovation Centre Nikola Tesla <https://www.icent.hr/en/>  
Novamina Innovative Technology Center <https://novamina.site123.me/>  
Science and Technology Park Step Ri <https://www.step.uniri.hr/>  
Zagreb Innovation Center ZiCer <https://www.zicer.hr/?lang=en>

#### Incubators

ZIP startup incubator <https://www.zipzg.com/en/>  
BIRD incubator <https://bird-incubator.com/>  
SPOCK <https://spock.fer.hr/en/>

#### Clusters

Cluster for Eco Social Innovation and Development CEDRA Split CEDRA Split <https://www.facebook.com/cedra.split>  
Supports agile, integrative and regenerative development of people, organizations, communities and eco-systems through training, consulting, projects and programs.

## 7. EXAMPLES OF BUSINESS SUPPORT ORGANIZATIONS IN PROJECT PARTNER COUNTRIES

### SLOVENIA

Here are some resources for you to tap into.

#### Research and Development

Centre of creative industries <https://czk.si/skupnost-czk/center-za-kreativne-industrije-maribor/>

InnoRenew CoE <https://innorenew.eu/>

InnoRenew CoE's mission is to advance the state of the art and achieve scientific and innovation excellence through interdisciplinary science, especially in our two key research areas: wood modification and restorative environmental and ergonomic design

#### Clusters

Wood industry cluster Slovenia <https://www.lesarski-grozd.si/en/>

The Wood Industry Cluster comprises a third of employees in forestry and wood-processing industry and the most important research institutions in Slovenia.

#### Regional Development Agencies

Regional Development Agency Podravje – Maribor [www.rra-podravje.si](http://www.rra-podravje.si)

## 7. EXAMPLES OF BUSINESS SUPPORT ORGANIZATIONS IN PROJECT PARTNER COUNTRIES

### SLOVENIA

#### Educational institutions

Association of headmasters of Slovenian highschools <https://www.zveza-zsd.si/o-zvezi/>

Carpentry and forestry high school Maribor <https://www.lsmb.si/srednja/>

#### Science and Technology parks

Styrian Technology Park <https://www.stp.si/>

Styrian Technology Park is focused on comprehensive support for SMEs in Podravje region, in different stages of their lifecycle – from the “setting up the business” stage, to the stages of growth, development, internationalization, restructuring activities, etc.. STP acts as the Regional Center for Technology Development.

#### Associations, networks

Regional Chamber of Craft and Small Business Maribor <https://ooz-maribor.si/sekcija-lesnih-strok/>

Chamber of Craft and Small Business of Slovenia <https://www.ozs.si/>

The Chamber of Commerce and Industry of Slovenia [https://www.gzs.si/zdruzenje\\_lesne\\_in\\_pohistvene\\_industrije/vsebinav2](https://www.gzs.si/zdruzenje_lesne_in_pohistvene_industrije/vsebinav2)



## 7. EXAMPLES OF BUSINESS SUPPORT ORGANIZATIONS IN PROJECT PARTNER COUNTRIES

### BELGIUM

Here are some resources for you to tap into.

#### Development Agencies

European Association of Development Agencies <https://www.eurada.org/>

#### Clusters

Flanders Make <https://www.flandersmake.be/en/>

Cluster Eco Construction <https://clusters.wallonie.be/federateur/index.html?IDC=3420>

#### Technology centers

CENTRE OF EXCELLENCE IN INFORMATION AND COMMUNICATION TECHNOLOGIES [www.cetic.be](http://www.cetic.be)

#### Accelerators

MateriaNOVA <http://www.materianova.be/en/>

Imec.istart <https://www.imecistart.com/en>

Novalis Biotechnology Incubation <https://noval.is/>

Lab.box <https://www.lab-box.com/>

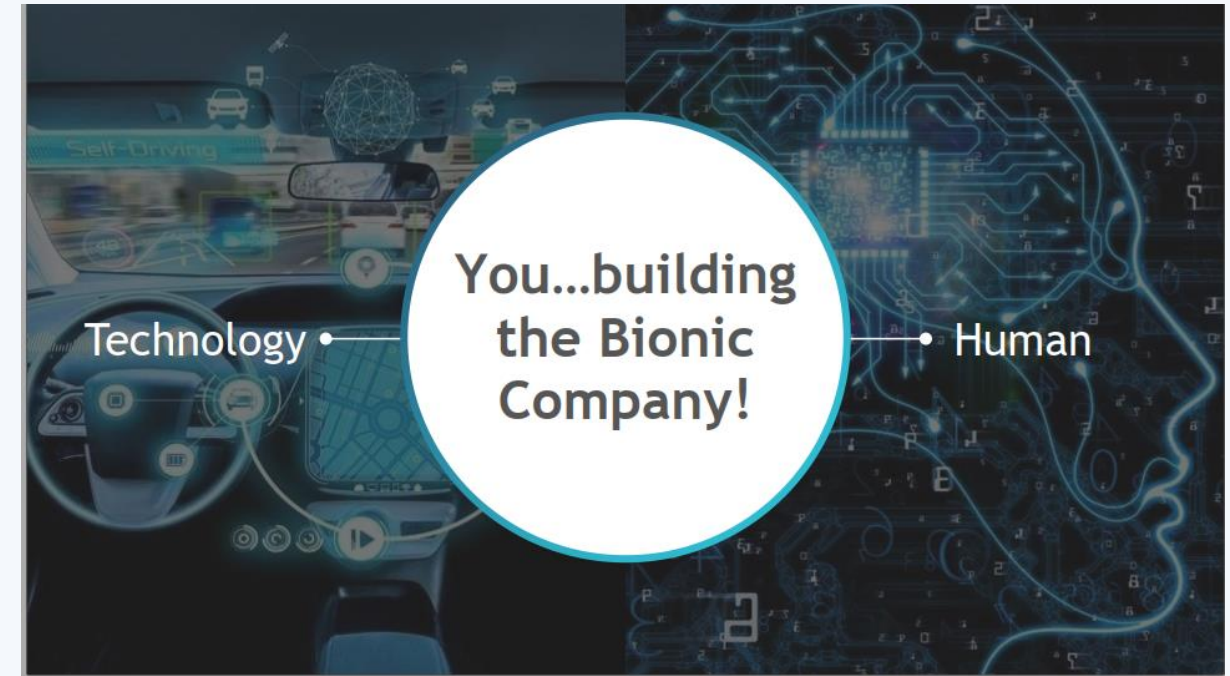
## 8. CONCLUSIONS

As you have seen, there are many organizations that support the ongoing growth of entrepreneurs and businesses in your region or in your country. Some have particular value on specific stages of your company development. Looking into each one to discern their potential value could be time-consuming and tedious.

Therefore, in this unit,

- You have learned the types of supporting organizations and what they can offer
- You are equipped with the quick guidelines on how to map the support environment and match them with your specific needs
- You have the list of resources to tap into to start looking for the support organizations in your countries.

Now go and get them!



*Building bionic company,. Source: Boston Consulting Group*

Your Text Here

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# Fostering diGitalisation and blonic transformation of SMEs through the development of a novel and innovative Training material for overcoming COVID-19 crisis

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you**

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# TU3. LU. 13

**TRAINING UNIT 3 - BT MANAGEMENT**

**LEARNING UNIT 13 - BIONIC TRANSFORMATION FUNDING OPPORTUNITIES**





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## 1. Introduction

## 2. Financing opportunities

### 2.1. European Digital Innovation Hubs (EDIHs)

- EDIHs services
- EDIH functions between region and EU

### 2.2. Funding opportunities for European projects

- EIC Accelerator
- LIFE
- European Regional Development Fund (ERDF)
- Horizon Europe
- Eurostars
- Erasmus+
- Green Deal

## 3. Search calls for proposals and tenders

### 3.1. Search for financing opportunities in Europe

### 3.2. How to apply for funding opportunities

### 3.3. Find funding partners

## 4. Conclusions



*Search calls and financing opportunities. Source: Freepik*

# 1. INTRODUCTION

European Commission supports access to funding for businesses through local financial institutions in EU countries.

The European Funds represent a unique opportunity for companies due to:

- the resources that will be received
- the digitalisation of the business fabric
- the change in the production model that is intended to be undertaken with it.



*European Commission. Source:  
European Commission official website*

Digitalisation and technological and sustainability development are the main axes of convergence for companies today and European financing funds are presented as a great opportunity to promote innovative, sustainable, modernizing and technological projects.

Through this document, companies will be trained on the different financing opportunities available at European level and in relevant national entities, as well as in the search and identification of relevant financial opportunities to help companies to promote digitalization.



*Sustainability and technology. Source: Freepik*

## 2. FINANCING OPPORTUNITIES

Access to finance is an important issue for innovative businesses to increase their competitiveness bringing to the market new technologies, new products, and new solutions for services.

Companies need to find calls for funding proposals, get information on funding processes and programmes, and apply mainly on-line.

In this section, you will find information on the different types of funding available for research and innovation for bionic transformation:

- European Digital Innovation Hubs (EDIHs)
- Funding opportunities for European projects



*Financiación. Source: Freepik*

## 2. FINANCING OPPORTUNITIES

### 2.1. EUROPEAN DIGITAL INNOVATION HUBS (EDIHs)

A European Digital Innovation Hub (EDIH) is a single organisation or a coordinated group of organisations with complementary expertise, with a not-for-profit objective that support digital transformation of companies of all forms and sizes, in particular SMEs, midcaps, scale-ups and public administrations across the Union. Source: [https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/digital/wp-call/2021/call-fiche\\_digital-2021-edih-01\\_en.pdf](https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/digital/wp-call/2021/call-fiche_digital-2021-edih-01_en.pdf)

EDIHs will be established as part of the European Commission's Digital Europe Programme to shape digital transformation over the 2021-2027 period.

EDIHs will function as one-stop shops that help companies dynamically respond to the digital challenges and become more competitive, as well as improve business/production processes, products, or services using digital technologies. They also provide innovation services, such as financing advice, training, and skills development that are needed for a successful digital transformation.



Meeting. Source: Pixabay



Business. Source: Pixabay

## 2. FINANCING OPPORTUNITIES

### 2.1. EUROPEAN DIGITAL INNOVATION HUBS (EDIHs)

EDIHs will have both local and European functions. EU funding will be made available for hubs that are already (or will be) supported by their Member States (or regions), in order to increase the impact of public funding.



*Budget. Source: Freepik*

The beneficiaries must declare that for the activities covered by the grant they pursue a not-for-profit objective, i.e., all money earned by them or donated to them is used in pursuing the EDIH's objectives and keeping it running.

EDIHs must have a plan of the actions to be carried out over the next 3 years, accompanied by a financial plan that contains an estimate of the funds necessary to pay for the planned actions.

EDIHs shall have substantial overall autonomy to define their organisation, composition, and working methods, but they should cover at least the technology side and the business development side and be capable of doing effective outreach.



*Team working. Source: Freepik*

## 2. FINANCING OPPORTUNITIES

### 2.1. EUROPEAN DIGITAL INNOVATION HUBS (EDIHs)

#### EDIHs SERVICES

The EDIH must provide a non-profit service offer that includes actions in each of the following fields:

- **Test before invest:** The Digital Europe draft regulation mentions: “raise awareness and provide, or ensure access to, digital transformation expertise, know-how and services, including testing and experimentation facilities”.
- **Skills and training:** To ensure the appropriate level of digital skills within the supported organisations in order to make the most of digital innovations technologies, EDIHs' services should include advertising, hosting or providing of training, boot-camps, traineeships, etc.
- **Support to find investments:** Guidance and support in the search for financing sources for the implementation of digital technological solutions, creation of consortiums for the preparation of financing applications.
- **Innovation ecosystem and networking:** The draft regulation mentions: “European Digital Innovation Hubs should act as facilitator to bring together industry, businesses and administrations which are in need of new technological solutions on one side, with companies, notably start-ups and SMEs that have market-ready solutions on the other side”.



Managers team. Source: Freepik



## 2. FINANCING OPPORTUNITIES

### 2.1. EUROPEAN DIGITAL INNOVATION HUBS (EDIHs)

#### EDIH FUNCTIONS BETWEEN REGION AND EU

The European Union, EU countries and regions work together to make the most of Digital Innovation Hubs. Source: <https://www.andaluciaagrotech.com/documents/3005206/3006788/Digital+Innovation+Hubs/67755f98-0dcb-46cf-b5ed-2677355476ed#:~:text=The%20European%20Union%2C%20EU%20countries,available%20in%20their%20local%20hubs.>

| REGIONS                                  | NATIONAL                                                                           | EUROPEAN UNION                                |
|------------------------------------------|------------------------------------------------------------------------------------|-----------------------------------------------|
| Support digital transformation           | Make sure their national strategy supports the creation of Digital Innovation Hubs | Provide a gateway to Europe                   |
| Enhance regional ecosystem collaboration | Secure the necessary financial means.                                              | Initiate/maintain interregional corridors     |
| Strengthen regional capacities           |                                                                                    | Support other regions with regional strengths |
| Improve regional specialisation          |                                                                                    | Enhance each other's capabilities             |



European Union. Source: Pixabay



## 2. FINANCING OPPORTUNITIES

### 2.2. FUNDING OPPORTUNITIES FOR EUROPEAN PROJECTS

The European Union has many funding programmes aimed at different innovative organizations with the objective of increasing the development of research activities in different fields. In this section, the most relevant EU calls for the bionic transformation have been selected.



*Digital transformation. Source: Pixabay*

## 2. FINANCING OPPORTUNITIES

### 2.2. FUNDING OPPORTUNITIES FOR EUROPEAN PROJECTS

#### EIC ACCELERATOR

The EIC Accelerator supports individual SMEs, in particular Startups and spinout companies, to develop and scaleup game-changing innovations. In addition, EIC selected companies receive coaching, mentoring, access to investors and corporates, and many other opportunities as part of the EIC community.

The EIC Accelerator provides substantial financial support with:

- Non-refundable aid of up to €2.5 million for innovation development costs.
- Investments (direct equity investments) of up to €15 million managed by the EIC Fund for scale up and other relevant costs. Companies working on technologies of strategic European interest can apply for EIC investments of more than €15 million.



*EIC Logo. Source: EIC website*



*Financiation. Source: Freepik*

## 2. FINANCING OPPORTUNITIES

### 2.2. FUNDING OPPORTUNITIES FOR EUROPEAN PROJECTS

#### EIC ACCELERATOR

Key aspects to win the EIC accelerator are as follows:

- Innovative high-tech concepts with high potential for scaling up the applicant company.
- High-risk innovations that cannot leverage the private investments to accelerate industrial scale-up.
- A compelling business plan: a clear timeline complemented by a strong team and track-record with financial data.
- Broader impact: the commercialisation of the innovation will have social, economic, environmental or climate impacts for at least Europe.



*Successful project. Source: Freepik*



*EIC Logo. Source: EIC website*

## 2. FINANCING OPPORTUNITIES

### 2.2. FUNDING OPPORTUNITIES FOR EUROPEAN PROJECTS

#### LIFE

The LIFE Programme is the European R&D&I funding instrument exclusively devoted to fund activities with environmental and climate objectives. Since 1992, more than 5,400 LIFE projects have been approved throughout the European Union. It is very important to note that all requested projects must present quantified and credible Key Performance Indicators (KPIs) to measure the expected impacts of the project in the different subprogrammes and areas.

The LIFE Programme Priorities are the following:

- Nature and Biodiversity
- Circular Economy and Quality of Life
- Climate Change Mitigation and Adaptation
- Clean Energy Transition



*Nature. Source: Freepik*



*LIFE Logo. Source: LIFE website*

## 2. FINANCING OPPORTUNITIES

### 2.2. FUNDING OPPORTUNITIES FOR EUROPEAN PROJECTS

#### LIFE

The main objectives of LIFE programme are:

- Contribute to the change towards a sustainable, circular, energy efficient, based on renewable energy, climate neutral and resilient economy.
- Protect, restore and improve the quality of EU's natural resources, including air, water and soil among others.
- Integrating the implementation of the EU's policy objectives for halting and reversing loss of biodiversity and wildlife habitats and species.
- Address the degradation of ecosystems, support the implementation and management of the Natura 2000 Network, thus contributing to sustainable development.



*LIFE Logo. Source: LIFE website*



*Goals. Source: Freepik*

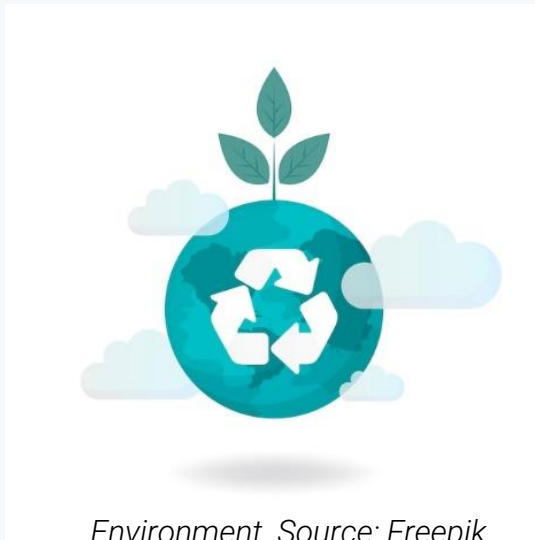
## 2. FINANCING OPPORTUNITIES

### 2.2. FUNDING OPPORTUNITIES FOR EUROPEAN PROJECTS

#### EUROPEAN REGIONAL DEVELOPMENT FUND (ERDF)

The European Regional Development Fund aims to strengthen economic and social cohesion in the European Union by correcting imbalances between its regions. The ERDF investments focus on several key priority areas, including innovation and research. In 2021-2027, it will enable investments in a smarter, greener, more connected and more social Europe that is closer to its citizens.

Operations under the ERDF are expected to contribute 30% of the overall financial envelope to climate objectives.



*Environment. Source: Freepik*



**EUROPEAN UNION**  
European Regional Development Fund

*ERDF. Source: EC website*

## 2. FINANCING OPPORTUNITIES

### 2.2. FUNDING OPPORTUNITIES FOR EUROPEAN PROJECTS

#### EUROPEAN REGIONAL DEVELOPMENT FUND (ERDF)

The [Funding priorities](#) are:

- More competitive and smarter, through innovation and support to small and medium-sized businesses, as well as **digitisation and digital connectivity**
- Greener, low-carbon and resilient
- More connected by enhancing mobility
- More social, supporting effective and inclusive employment, education, skills, social inclusion and equal access to healthcare, as well as enhancing the role of culture and sustainable tourism
- Closer to citizens, supporting locally-led development and sustainable urban development across the EU



*Innovation. Source: Freepik*



*Teamwork. Source: Freepik*



**EUROPEAN UNION**  
European Regional Development Fund

*ERDF. Source: EC website*



## 2. FINANCING OPPORTUNITIES

### 2.2. FUNDING OPPORTUNITIES FOR EUROPEAN PROJECTS

#### HORIZON EUROPE 2021-2027

Horizon Europe (HE) is the current research and innovation programme of the European Union (successor to Horizon 2020), has a budget of €95.5 billion for the 2021-2027 period.

The programme facilitates collaboration and strengthens the impact of research and innovation in developing, supporting and implementing EU policies while tackling global challenges. It supports the creation and better dissemination of excellent knowledge and new technologies.



*Horizon Europe. Source: EC website*

## 2. FINANCING OPPORTUNITIES

### 2.2. FUNDING OPPORTUNITIES FOR EUROPEAN PROJECTS

#### HORIZON EUROPE 2021-2027

This new programme is based on three main pillars:

- PILLAR 1: EXCELLENT SCIENCE

The Pillar of Excellent Science aims to increase the global scientific competitiveness of the European Union

- PILLAR 2: GLOBAL CHALLENGES AND EUROPEAN INDUSTRIAL COMPETITIVENESS

This pillar focuses on strengthening the impact of research and innovation for economic development and competitiveness. It also supports the adoption of innovative solutions in industry and society to address global challenges:

- Health;
- Culture, Creativity and Inclusive Society;
- Civil Security for Society;
- Digital, Industry and Space;
- Climate, Energy and Mobility;
- Food, Bioeconomy, Natural Resources, Agriculture and Environment;

- PILLAR 3: INNOVATIVE EUROPE

In Pillar III, the programme focus on supporting the development of disruptive and market-creating innovations and on enhancing European innovation ecosystems.



*Challenges. Source: Freepik*

## 2. FINANCING OPPORTUNITIES

### 2.2. FUNDING OPPORTUNITIES FOR EUROPEAN PROJECTS

#### EUROSTARS

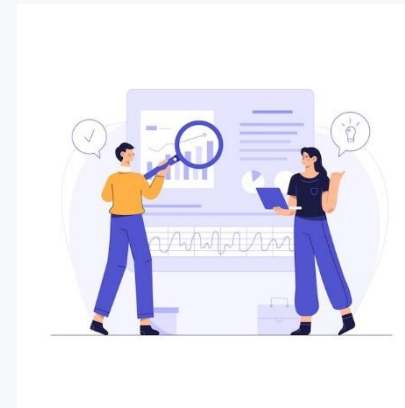
Eurostars supports research-performing SMEs that develop innovative products, processes and services to gain a competitive advantage. The programme integrates specific improvement measures with the aim of reducing recruitment times, cutting management and achieving greater synchronisation and integration of funding.

Up to 37 European EUREKA network member countries participate in this funding programme, and since 2016, Canada and South Africa also participate. The funding is managed by National Funding Agencies.

Projects to be funded must be technically innovative and have a clear market orientation, with a maximum of 2 years of market entry from the completion of the development project. This means that projects will be funded if they are in a state of technological development corresponding to a TRL4-6 at the start of the project.



*Eurostars' Logo. Source: CDTI*



*R&D. Source: Freepik*

## 2. FINANCING OPPORTUNITIES

### 2.2. FUNDING OPPORTUNITIES FOR EUROPEAN PROJECTS

#### ERASMUS+

Erasmus+ is an EU programme for education, training, youth and sport.

The 2021-2027 Erasmus+ is more inclusive, more digital, and greener.

[Organisations](#) wanting to participate in Erasmus+ may engage in a number of development and networking activities, including strategic improvement of the professional skills of their staff, organisational capacity building, and creating transnational cooperative partnerships with organisations from other countries in order to produce innovative outputs or exchange best practices.

#### Key Action 1: Learning mobility of individuals

The role of the organisations in this process is to organise these opportunities for individuals. The benefits for the organisations include an increased capacity to operate at an international level, improved management skills, access to more funding opportunities and projects, etc.

#### Key Action 2: Cooperation among organisations and institutions

The cooperation among organisations and institutions is expected to result in the development, transfer and/or implementation of innovative practices at organisational, local, regional, national or European levels.

#### Key Action 3: Support for policy reform

Organisations will contribute to improving the quality of education, training, and youth systems in Europe, as well as promoting transnational learning and cooperation between authorities.



*Erasmus+ Logo. Source: Wikimedia Commons*



*Collaborative project Source: Freepik*

## 2. FINANCING OPPORTUNITIES

### 2.2. FUNDING OPPORTUNITIES FOR EUROPEAN PROJECTS

#### GREEN DEAL

The Green Deal is an integral part of this Commission's strategy to implement the United Nations' Agenda 2030 the Sustainable Development Goals, as well as the policy guidelines announced by President Ursula Von der Leyen.

Green Deal is a new strategy for sustainable growth that aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy, where there are no net greenhouse gas emissions in 2050 and where economic growth is decoupled from resource use.



This call is a direct contribution to the European Commission's European Green Deal, the European Commission's blueprint and roadmap to make Europe the first climate neutral continent by 2050, with a sustainable economy that leaves no one behind.

*Green Deal Call. Source: EC website*

## 2. FINANCING OPPORTUNITIES

### 2.2. FUNDING OPPORTUNITIES FOR EUROPEAN PROJECTS

#### GREEN DEAL

Actions:

- [Climate Action: Path to climate neutrality](#)
- [Protecting the environment and oceans](#)
- [A clean energy transition](#)
- [Transport: Providing efficient, safe and environmentally friendly transport](#)
- [Agriculture: A healthy food system for people and planet](#)
- [Finance and the Green Deal: Investing in a green future](#)
- [Industry: An industrial strategy for a competitive, green, digital Europe](#)
- [Research and innovation driving transformative change](#)



*Sustainable. Source: Freepik*

## 2. FINANCING OPPORTUNITIES

### 2.2. FUNDING OPPORTUNITIES FOR EUROPEAN PROJECTS

#### GREEN DEAL

Green Deal Projects funded under this call are expected to deliver results with tangible benefits in ten areas:

- Area 1. Climate Ambition: Cross sectoral challenges
- Area 2: Clean, affordable and secure energy
- Area 3: Industry for a Clean and Circular Economy
- Area 4: Energy and Efficient Building
- Area 5: Sustainable and Smart Mobility
- Area 6: Farm to Fork
- Area 7: Biodiversity and Ecosystem services
- Area 8: Zero-pollution, toxic-free environment
- Area 9: Strengthening our knowledge in support of the EGD
- Area 10: Empowering citizens for the transition towards a climate neutral, sustainable Europe



*Sustainability. Source: Freepik*

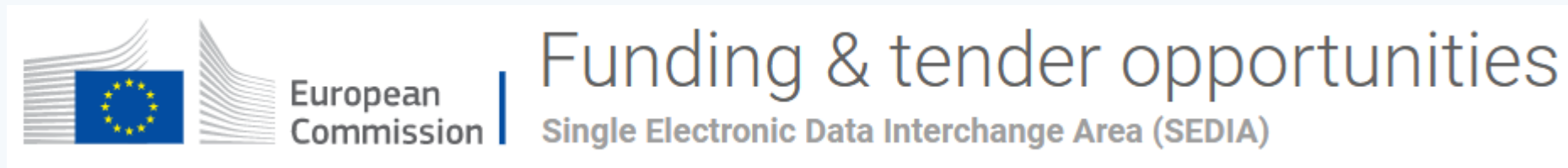


### 3. SEARCH CALLS FOR PROPOSALS AND TENDERS

#### 3.1. SEARCH FOR FINANCING OPPORTUNITIES IN EUROPE

To find a suitable call for proposal, the European Commission and its funding bodies publish information on the Funding & Tenders Portal, the single point of entry for all EU funding and tenders, i.e., grants, prizes and procurements managed by the European Commission and other EU services.

This tool aims to help organizations find and apply for suitable EU funding and tender opportunities.

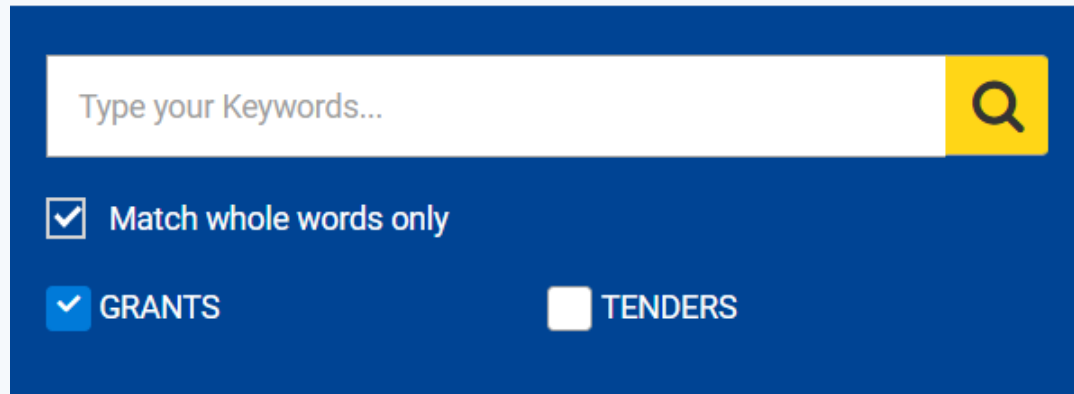


*SEDIA. Source: EC Website*

### 3. SEARCH CALLS FOR PROPOSALS AND TENDERS

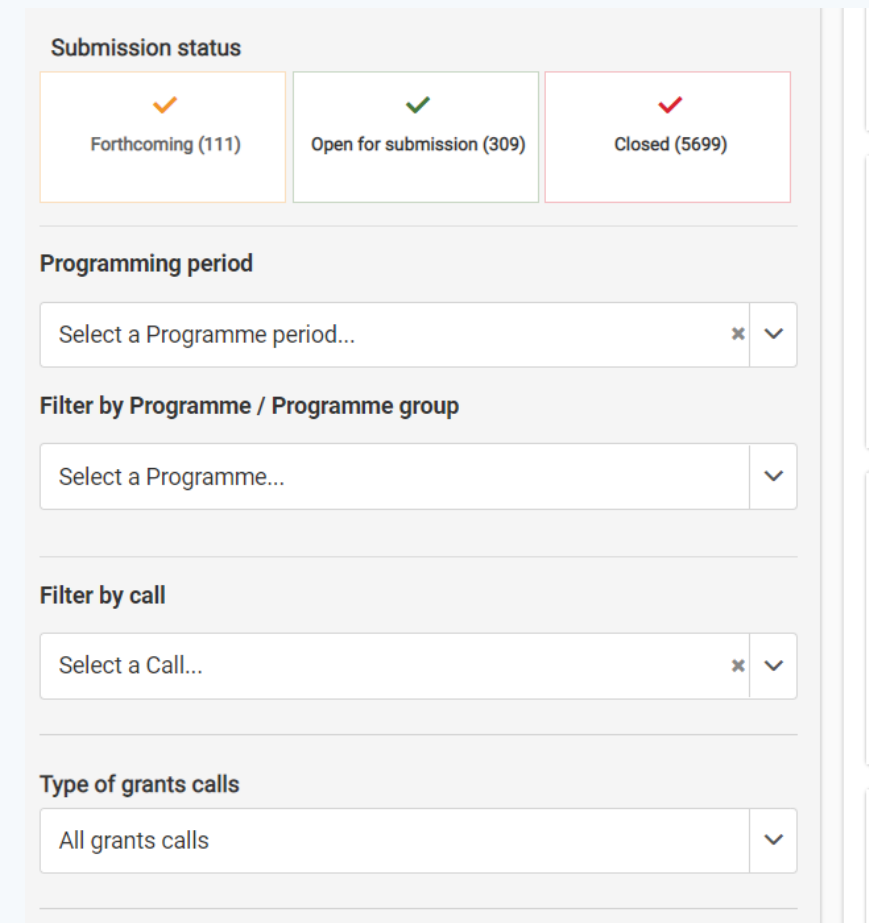
#### 3.1. SEARCH FOR FINANCING OPPORTUNITIES IN EUROPE

You may start the search from the home page by entering keywords that characterize best your field of interest, and then refine the results with the help of further filters.



The image shows the search interface of the SEDIA keyword search engine. It features a dark blue header with a white search bar containing the placeholder text "Type your Keywords...". To the right of the search bar is a yellow magnifying glass icon. Below the search bar, there are two checkboxes: "Match whole words only" (checked) and "GRANTS" (checked). To the right of these is a "TENDERS" button with a white square icon.

*Keyword search engine SEDIA. Source: SEDIA*



The image shows the filter interface of the SEDIA search engine. It includes several sections for refining search results:

- Submission status:** Three buttons with checkmarks: "Forthcoming (111)" (orange), "Open for submission (309)" (green), and "Closed (5699)" (red).
- Programming period:** A dropdown menu with the text "Select a Programme period..." and a clear (x) button.
- Filter by Programme / Programme group:** A dropdown menu with the text "Select a Programme..." and a clear (x) button.
- Filter by call:** A dropdown menu with the text "Select a Call..." and a clear (x) button.
- Type of grants calls:** A dropdown menu with the text "All grants calls" and a clear (x) button.

*Filters search engine SEDIA. Source: SEDIA*

### 3. SEARCH CALLS FOR PROPOSALS AND TENDERS

#### 3.1. SEARCH FOR FINANCING OPPORTUNITIES IN EUROPE

The main filters to refine the search in the "FUNDING & TENDERS PORTAL– SINGLE ELECTRONIC DATA INTERCHANGE AREA (SEDIA)" portal are the following:

- Submission status:
  - Forthcoming
  - Open for submission
  - Closed
- Programming period
- Filter by Programme / Programme group
- Filter by call
- Type of grants calls

Click on the topic title to access the call description page

Funding and tenders (10000)

Need help?

Submission status

Sort by

There are more than 10000 results, please refine your search criteria.

Alternative Fuel Infrastructure Facility - Unit Contributions

CEF-T-2021-AFIFCOEN-UNITS

Call for proposal

Grant

|                |                                  |                |                                     |
|----------------|----------------------------------|----------------|-------------------------------------|
| Programme      | Connecting Europe Facility (CEF) | Status         | Open for submission                 |
| Type of action | CEF AFIF-EVRI Unit Grants        | Deadline model | multiple cut-off                    |
| Opening date   | 16 September 2021                | Next deadline  | 07 June 2022 17:00:00 Brussels time |

Alternative Fuel Infrastructure Facility - Works - LNG

CEF-T-2021-AFIFCOEN-WORKS-LNG

Call for proposal

Grant

|                |                                  |                |                                     |
|----------------|----------------------------------|----------------|-------------------------------------|
| Programme      | Connecting Europe Facility (CEF) | Status         | Open for submission                 |
| Type of action | CEF Infrastructure Projects      | Deadline model | multiple cut-off                    |
| Opening date   | 16 September 2021                | Next deadline  | 07 June 2022 17:00:00 Brussels time |

Alternative Fuel Infrastructure Facility - Unit Contributions

CEF-T-2021-AFIFGEN-UNITS

Call for proposal

Grant

|                |                                  |                |                                     |
|----------------|----------------------------------|----------------|-------------------------------------|
| Programme      | Connecting Europe Facility (CEF) | Status         | Open for submission                 |
| Type of action | CEF AFIF-EVRI Unit Grants        | Deadline model | multiple cut-off                    |
| Opening date   | 16 September 2021                | Next deadline  | 07 June 2022 17:00:00 Brussels time |

Search example. Source: SEDIA

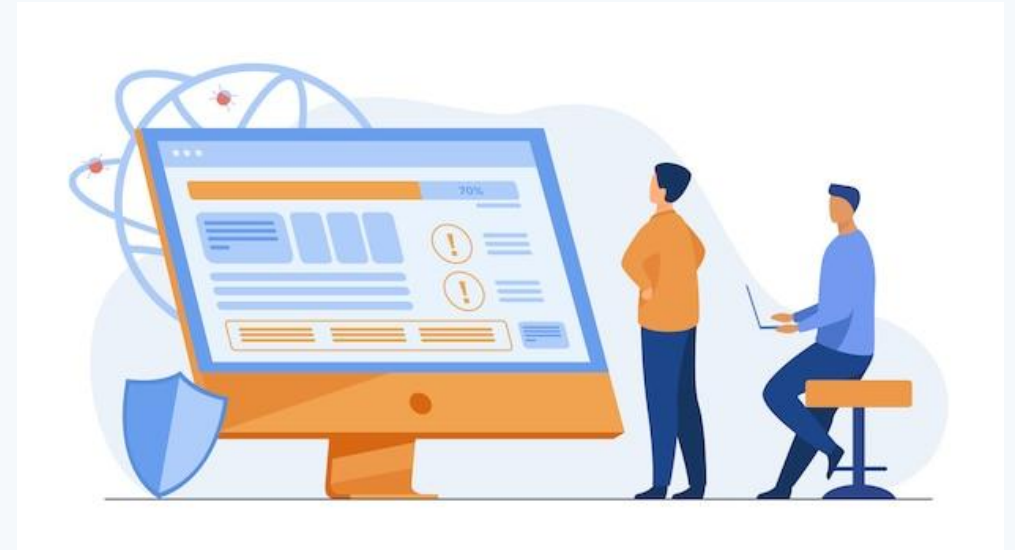
## 3. SEARCH CALLS FOR PROPOSALS AND TENDERS

### 3.1. SEARCH FOR FINANCING OPPORTUNITIES IN EUROPE

There is the possibility of accessing the tool periodically and carrying out the necessary searches, or you can receive updates on new calls by subscribing to the Funding Opportunities RSS channel.

On the Portal most calls are divided into topics.

The Topic page contains all the information you need for your proposal (call conditions, legal framework and key documents, standard application form and other practical information you need to prepare your proposal), as also specifies the deadline and show a link to the Portal Submission System, through which you can submit your proposal. The Topic page also contains call and topic updates.



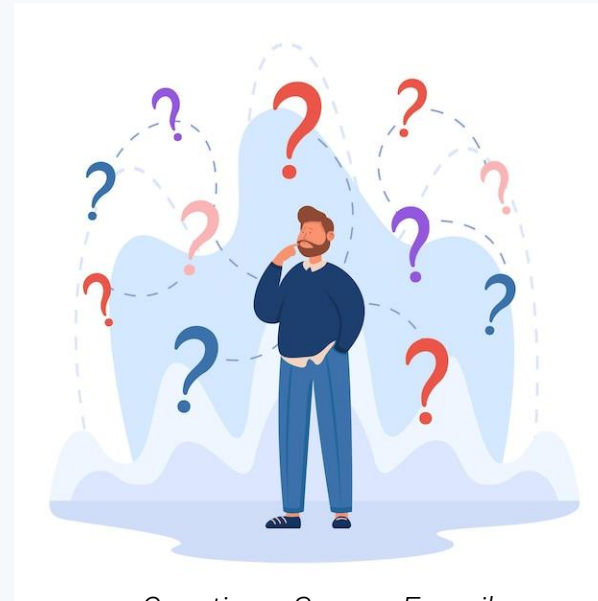
*Search information. Source: Freepik*

## 3. SEARCH CALLS FOR PROPOSALS AND TENDERS

### 3.1. SEARCH FOR FINANCING OPPORTUNITIES IN EUROPE

There are different aspects to consider when searching for financing opportunities in Europe:

- Calls and topics: On the Portal most calls are divided into topics.
- A topic is open until the deadline for submission has passed (call deadline).
- For most topics, you must submit a full proposal by the call deadline.
- Some topics have a 2-stage, while others have no deadline and can apply at any time of the year.



*Questions. Source: Freepik*

## 3. SEARCH CALLS FOR PROPOSALS AND TENDERS

### 3.1. SEARCH FOR FINANCING OPPORTUNITIES IN EUROPE

Calls in the field of innovation (close to market) often use the notion of technology readiness level to specify also the level of technology readiness that is expected from the projects. There are 9 technology readiness levels:

- TRL 1 – basic principles observed
- TRL 2 – technology concept formulated
- TRL 3 – experimental proof of concept
- TRL 4 – technology validated in lab
- TRL 5 – technology validated in relevant environment
- TRL 6 – technology demonstrated in relevant environment
- TRL 7 – system prototype demonstration in operational environment
- TRL 8 – system complete and qualified
- TRL 9 – actual system proven in operational environment



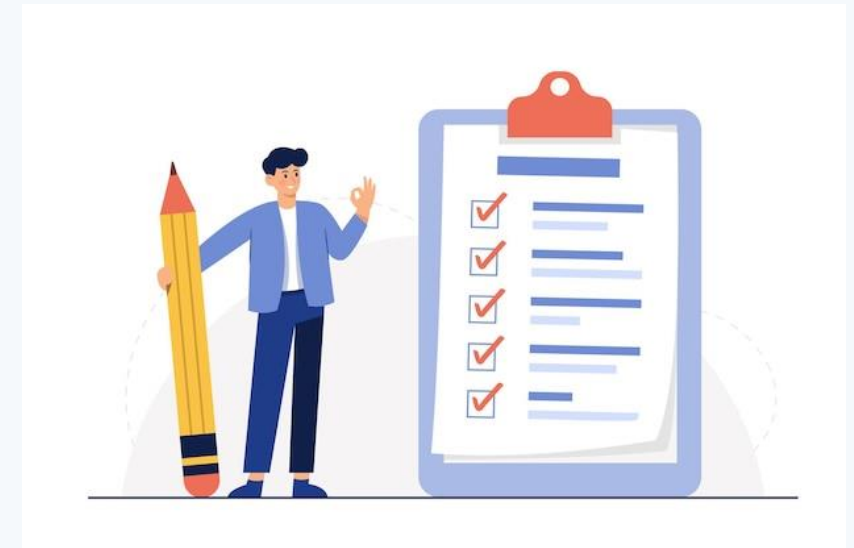
*Research and Innovation. Source: Freepik*

### 3. SEARCH CALLS FOR PROPOSALS AND TENDERS

#### 3.2. HOW TO APPLY FOR FUNDING OPPORTUNITIES

Each call for proposals/projects has its own criteria and requirements. Your chosen call will guide you through the application process, however there are general steps to applying for funds directly managed by the European Commission.

- Register: each user needs an EU Login account to log in.
- Eligibility: to see whether your organisation is eligible for funding, check the call conditions on the Topic page.
- Find a project partner (optional): most funding opportunities are collaborative projects.
- Prepare and submit your proposal.



*Apply document. Source: Freepik*

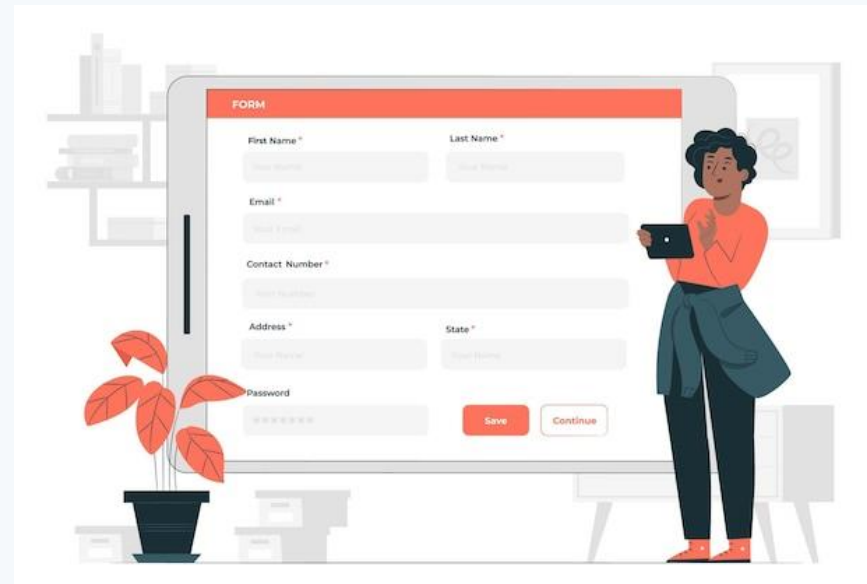


## 3. SEARCH CALLS FOR PROPOSALS AND TENDERS

### 3.2. HOW TO APPLY FOR FUNDING OPPORTUNITIES

In order to be valid, the application must be:

- Submitted on time: before the closing date specified in the call - through the electronic submission system.
- Complete: accompanied by the relevant administrative forms, proposal description and any supporting documents specified in the call.
- Concise: the proposal template will specify a maximum number of pages.



*Form. Source: Freepik*

## 3. SEARCH CALLS FOR PROPOSALS AND TENDERS

### 3.3. FIND FUNDING PARTNERS

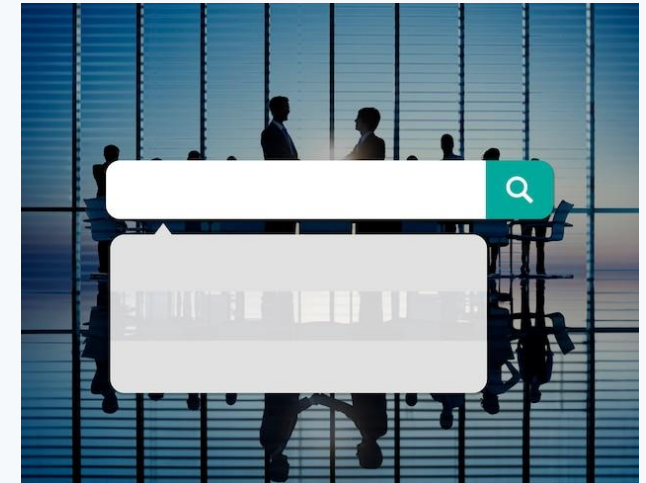
Most EU-funded projects involve collaboration between organisations from different EU countries or associated countries. The [partner search tool](#) helps you find partners for your project among the many participants of past EU projects and there are several search facilities available to find suitable partners.

To see whether a call requires minimum consortium composition, check the call conditions on the Topic page.



*Consortium. Source: Freepik*

The aim of targeting most of the calls at multi-beneficiary consortia is to enhance EU added value, promote cooperation between organisations from different countries, strengthen the quality of applications and ensure fair competition and equal opportunities across the EU



*Search partners. Source: Freepik*

## 3. SEARCH CALLS FOR PROPOSALS AND TENDERS

### 3.3. FIND FUNDING PARTNERS

#### Who can be a partner?

Any company, organisation or non-governmental organisation can be a partner, regardless of where they are based, as long as they are financially viable and qualified to carry out the tasks specified in the project proposal.



*Partners. Source: Freepik*

Moreover, all participants (Beneficiaries, Affiliated Entities and Associated Partners) must be registered in [the Participant Register](#) and be validated by the [Central Validation Service](#).

## 3. SEARCH CALLS FOR PROPOSALS AND TENDERS

### 3.3. FIND FUNDING PARTNERS

Each applicant is free to find its own partners, but there are various partner search services that can help you find organisations wanting to participate in proposals or to publish your own offers of collaboration, for example the European Commission [partner search tool](#) and you can also find partners when [responding to a procurement procedure as a consortium](#)

Consortium participants will be jointly responsible for the implementation of the project activities (according to their proposal/description of the action). If a project is not completed (or is poorly implemented), the grant may be reduced for all.



*Consortium participants . Source: Freepik*

## 3. SEARCH CALLS FOR PROPOSALS AND TENDERS

### 3.3. FIND FUNDING PARTNERS

When setting up your grant consortium, you should think of organisations that help you reach objectives and solve problems and the source should be attributed according to the level of participation in the project:

- Beneficiaries
- Affiliated Entities
- Associated Partners
- Subcontractors
- Coordinator
- Other Beneficiaries



*Partners. Source: Freepik*

## 3. SEARCH CALLS FOR PROPOSALS AND TENDERS

### 3.3. FIND FUNDING PARTNERS

To find partners for your project ideas, you can:

- Use the [Partner Search](#) function of the Portal.
- Use other Partner Search tools and services.
- Participate in conferences, brokerage events organised by the EU or networks in the Member States (National Contact Points or Desks, Enterprise Europe Network, etc.).



*Find partners. Source: Freepik*

### 3. SEARCH CALLS FOR PROPOSALS AND TENDERS

#### 3.3. FIND FUNDING PARTNERS

If you want to find experienced partners who already have ongoing projects, or if you want to search in the database of registered organisations, visit the Partner Search page. You can search by:

- Keyword
- Geographical area
- Programme / Topic
- Organisation
- Person profile

Search results include full organisation profiles with lists of funded projects and the possibility to contact representatives.

☒ Organisations
 ☒ Persons
 [Advanced search ^](#)

**Programme / Topic**

Programme

Select a Programme... ▾

Topic

Select a Topic... ▾

**Location**

Country

Select a Country... ▾

City ⓘ

Type a City...

**Organisation**

Organisation type

Select an Organisation type... ▾

**Person profile**

Professional profile

Select a Professional profile... ▾

☐ Profiles with published Partner search announcements (8743)

Advance Search Partner Search. Source: Freepik



## 4. CONCLUSIONS

European Commission supports access to funding for businesses through local financial institutions in EU countries and there are different financing opportunities to bionic transformation available at European level, at the national level and regional level.

Some of the most important programmes are: European Digital Innovation Hubs (EDIHs), EIC Accelerator, LIFE, European Regional Development Fund (ERDF), Horizon Europe, Erasmus +, Eurostars and Green Deal.

It is important to know the tools and strategies to search for financing opportunities, as well as the search for partners for your project, since most funding opportunities are collaborative projects.

The European Commission has different specific portals to search for calls and for partners. There are different types of EU funding available for research and innovation and it's important to know to search financing opportunities for bionic transformation.



*Financing opportunities. Source: Freepik*



*Search Financing opportunities. Source: Freepik*

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**[HTTPS://GIST-PROJECT.EU/](https://gist-project.eu/)**



# Thank you



# TU. 4

# LU. 14

**TRAINING UNIT 4 – BT CASE STUDY**

**LEARNING UNIT 14 – BEST BT PRACTICES**

Your Text Here



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This project has been funded with support from the European Commission (Ref: 2020-1-DE02-KA226-008154).

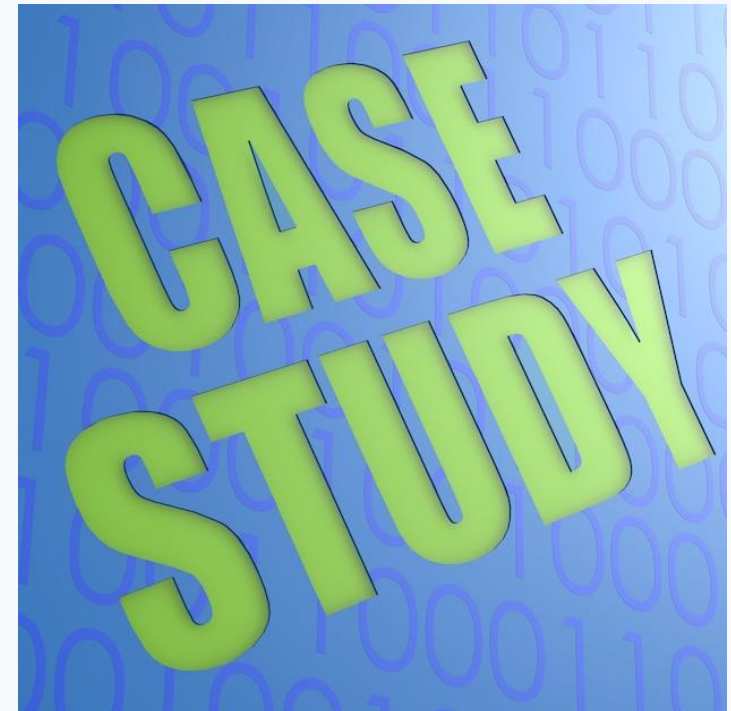
## DISCLAIMER

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In this learning unit you will see 6 cases of digitalization transformation in various companies. The examined cases in this unit will help you in the next unit, where you will try and suggest modification to hypothetical companies.

1. Bionic Transformations Study Case
2. Digital Transformation Study Case #1: Slovenia
3. Digital Transformation Study Case #2: Croatia
4. Digital Transformation Study Case #3: Germany
5. Digital Transformation Study Case #4: Poland
6. Digital Transformation Study Case #5: Spain
7. Digital Transformation Study Case #6: Belgium
8. Food for thought
9. Further insight into cases



*Source: Freepik*

# 1. BIONIC TRANSFORMATIONS STUDY CASE



In this learning unit the GIST partnership presents to you 6 study cases of digital transformation from the following countries:

- 1) Slovenia
- 2) Croatia
- 3) Germany
- 4) Poland
- 5) Spain
- 6) Belgium

The examples will provide you practical insight in bionic transformation of companies.

Pay attention to the common challenges and applied solution among companies active in different fields.



## 2. DIGITAL TRANSFORMATIONS STUDY CASE #1: SLOVENIA

**Case #1:** A company dedicated to support other companies in achieving digital transformation.

### **Suggested focus:**

We suggest you focus on the methodology they use to identify the opportunities for bionic transformation of companies they are supporting.

Also, note the challenges the companies face and the solutions applied.

What are the expected benefits for these companies?



Source: Pixabay

## 2. DIGITAL TRANSFORMATIONS STUDY CASE #1: SLOVENIA

**Name of the company:** Komunikacije prihodnosti d.o.o.

**Year of establishment:**2008

**Original core business:** M72 - Scientific research and development

**Current core business:** M72 - Scientific research and development



**KOMUNIKACIJE PRIHODNOSTI**  
Digital transformations

## 2. DIGITAL TRANSFORMATIONS STUDY CASE #1: SLOVENIA

Komunikacije prihodnosti d.o.o. is an innovative company with more than 10 years of experience in planning, consulting, training and project implementation in the field of business analysis, customer experience, business support processes, innovative digital business models and products. They provide support to other companies (especially SMEs) on their way to achieving digitalization.

The owner has participated in numerous research and development projects, demo projects and innovations.



Source: Pixabay

## 2. DIGITAL TRANSFORMATIONS STUDY CASE #1: SLOVENIA

The company is supporting others in their goal to achieve digital transformation.

The challenges that companies face are:

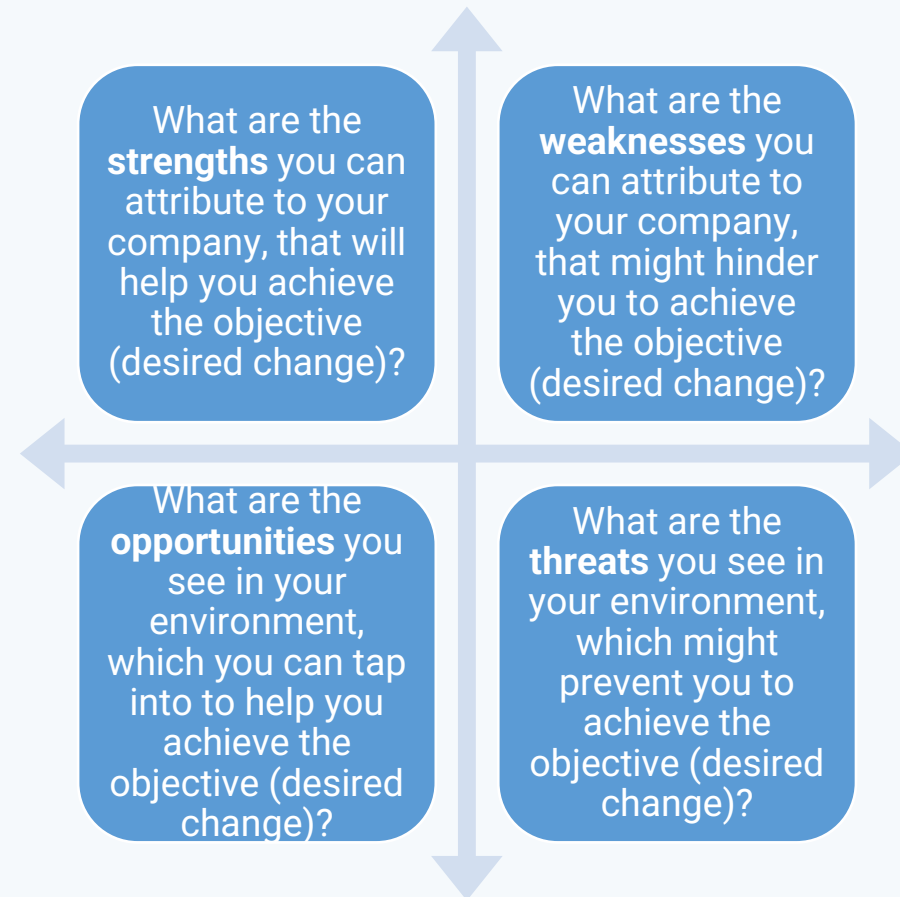
- New forms of digital business
- Rapid change
- All digital - business models, digital platforms
- Disruption of existing markets (new competition)
- Creating new markets (opportunities)
- Emphasis on customer experience
- Personalization
- Instead of a one-time purchase -> service



Source: Pixabay

## 2. DIGITAL TRANSFORMATIONS STUDY CASE #1: SLOVENIA

In support to digitalization of other companies, Komunikacije prihodnosti helps prepare a digital strategy, for which the company has to know what to achieve. This is usually done with the help of a SWOT analysis (or similar tools):



## 2. DIGITAL TRANSFORMATIONS STUDY CASE #1: SLOVENIA

There are several elements of digital business that can be implemented and Komunikacije prihodnosti help SMEs identify what suits them best.

Big Data



Artificial intelligence



Cloud computing



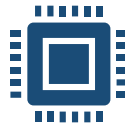
Cyber security



Blockchain



Internet of things - IOT



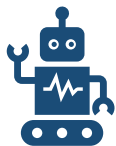
Digital marketing



Social networks



Robotization



Virtual reality - VR



3D printing



Industry 4.0



## 2. DIGITAL TRANSFORMATIONS STUDY CASE #1: SLOVENIA

### CUSTOM ORGANIZATIONS

- Slow adjustment
- Small amount of data
- Unrelated data
- Limited cooperation between sectors (silos)
- Limited customer interaction



### DIGITAL ORGANIZATIONS

- Agile and digital business
- Large amount of data on all aspects of the business
- Exploitation of big data / AI
- Connectivity within the company and other aspects of the business
- Coping with demanding customers



## 2. DIGITAL TRANSFORMATIONS STUDY CASE #1: SLOVENIA

There are several steps for developing a digital strategy that they apply:

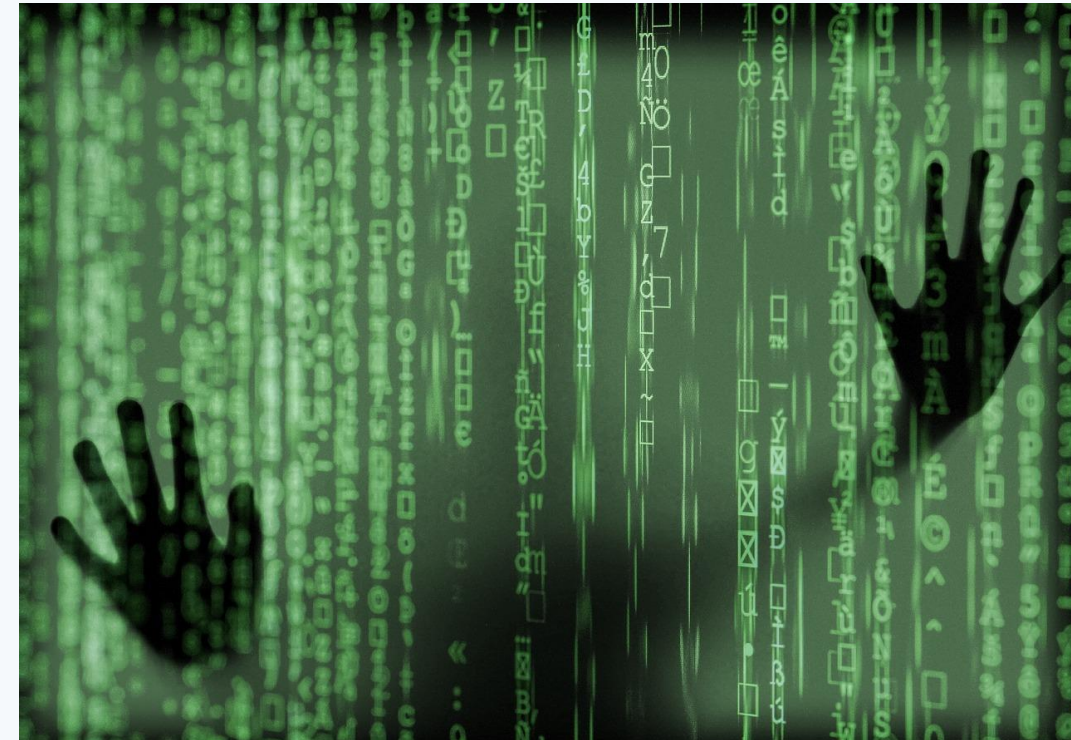
- What do you want to achieve with digital strategy?
- Selection of a professional partner for digitization (DIH catalog)
- Presentation of the company, vision and goals (especially in terms of changes due to digitalization)
- Assessment of the current state of digitalization in the company itself
- Creating a company strategy for digital transformation with key areas (7 or 8 areas)
- Company's digital capability development plan
- Preparation of the final Digital Strategy (5 years) and Action Plan (more details for 12-18 months)



Source: Pixabay

## 2. DIGITAL TRANSFORMATIONS STUDY CASE #1: SLOVENIA

- The digital maturity of a company is its level of development in the field of features of the digital economy and digital elements such as: digital customer, digital strategies, digital technologies, operations, culture, management and leadership.
- The company assesses the state of its digital maturity on the basis of established approaches and indicators. Mandatory areas of assessment covered by the maturity assessment should cover all key areas of the digital strategy.
- The evaluation should include the results (status) and recommendations that are important for the development of a digital strategy. They can also be written in the form of a SWOT analysis. The assessment summarizes the test results and other analyzes of the company, such as analysis of the competitive position of the company.



Source: Pixabay

## 2. DIGITAL TRANSFORMATIONS STUDY CASE #1: SLOVENIA

Example of obstacles of a company @Nomnio that was supported by Komunikacije prihodnosti:

- Heterogeneous system and application landscapes.
- How to gain data and how to analyse.
- Which functions (design) should be supported by which systems
- Product life-cycle management,
- Enterprise resource planning,
- Manufacturing execution,
- Supply-chain management...
- Where those systems should be deployed—on the edge, at the manufacturing site, or in the cloud?
- More nodes = more security complexity. Latency and security necessities.
- Internal or external team?



*Source: Pixabay*

## 2. DIGITAL TRANSFORMATIONS STUDY CASE #1: SLOVENIA

The solutions implemented:

SMART ecosystems are growing and improving by the day.

- Collaboration—with high levels of expertise in areas such as analytics, IIoT, and cloud platforms within the industrial software stack—can (must!) be a competitive advantage.
- Mastering these complexities means overcoming the integration challenge between business operations, organization, existing technology and future technology.

We offer rich experience and implementation to accelerate digital transformation and position organizations to reap the full set of its benefits.



Source: Pixabay



## 2. DIGITAL TRANSFORMATIONS STUDY CASE #1: SLOVENIA

Together with our business partners, we offer IT systems planning, control and management services, as well as the possibility to rent complete ICT equipment. We offer server hosting, solutions for various communication networks, cybersecurity for data and networks, know-how and equipment to set up data centres within companies. We also share a common IoT platform, which is one of the most important technologies enabling Industry 4.0.



Source: Pixabay

## 2. DIGITAL TRANSFORMATIONS STUDY CASE #1: SLOVENIA

Komunikacije prihodnosti will keep developing:

- Customer experience
- Data strategy
- Business support processes and digital solutions
- Digital business models, products and services
- Digital staffing and digital jobs development strategy
- Digital culture development strategy
- Cyber security
- Industry 4.0



*Source: Pixabay*

## 2. DIGITAL TRANSFORMATIONS STUDY CASE #1: SLOVENIA

What are the advantages of a digital organizations over custom ones?

What type of analysis are performed within a company, to prepare a digitalization strategy?

Which are the steps a company should do, to achieve digitalization?

Which elements determine the digital maturity of a company and its business?



*Source: Pixabay*



### 3. DIGITAL TRANSFORMATIONS STUDY CASE #2: CROATIA

**Case #2:** A dentistry company that was established in 1966 that could still function without transformation.

**Suggested focus:**

We suggest you focus on the benefits the company saw in digital transformation, which made them decide to transform.

Also, note the barriers they faced and how they overcame them.

Does the company have an expansion plan for the future?



Source: Pixabay

### 3. DIGITAL TRANSFORMATIONS STUDY CASE #2: CROATIA

**Name of the company:** DENTAL MEDICINE DOCTOR STARČEVIĆ

**Year of establishment:** 1966

**Original core business (before transformation):** dentistry

**Current core business (what they do now):** dentistry, aesthetic dentistry



### 3. DIGITAL TRANSFORMATIONS STUDY CASE #2: CROATIA

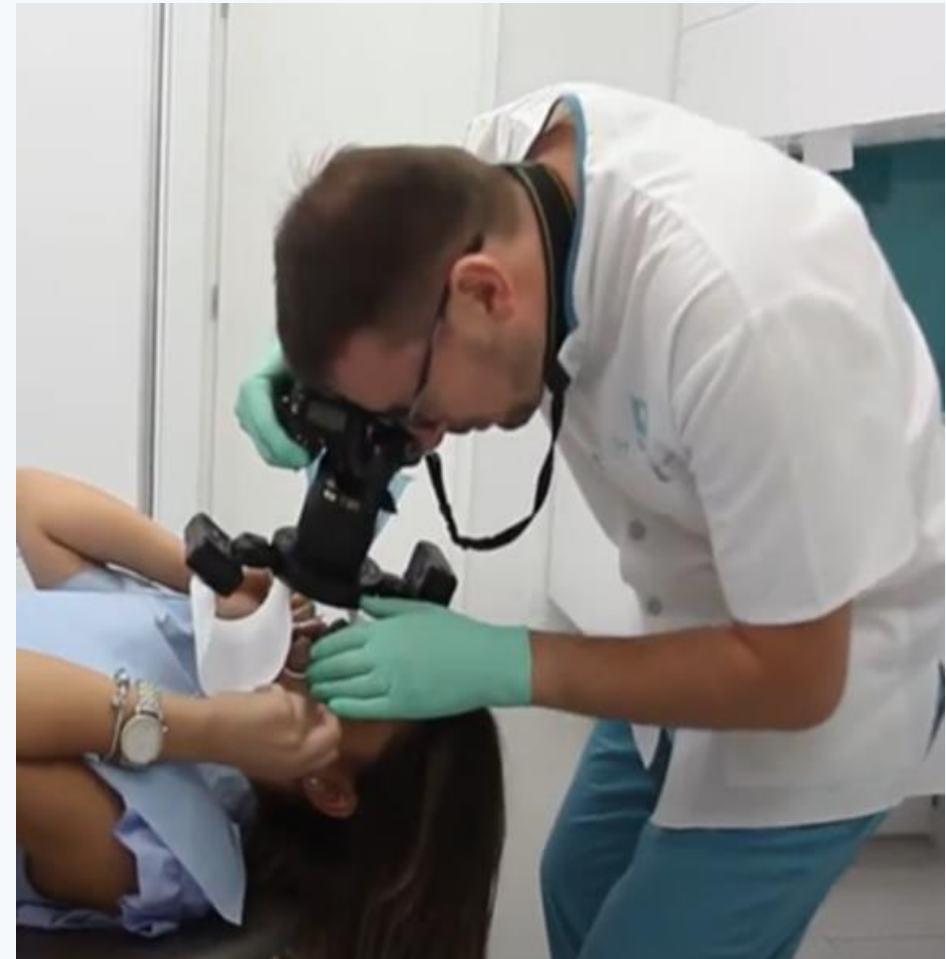
Dental Medicine Clinic Dr.Starčević was founded in 1966.

Offer of services:

- A complex dental program at the level of the applicable world standards,
- Preventive treatments,
- Repairs and treatment,
- Whitening
- Prosthetics
- Surgery

NEW

- aesthetic dentistry services



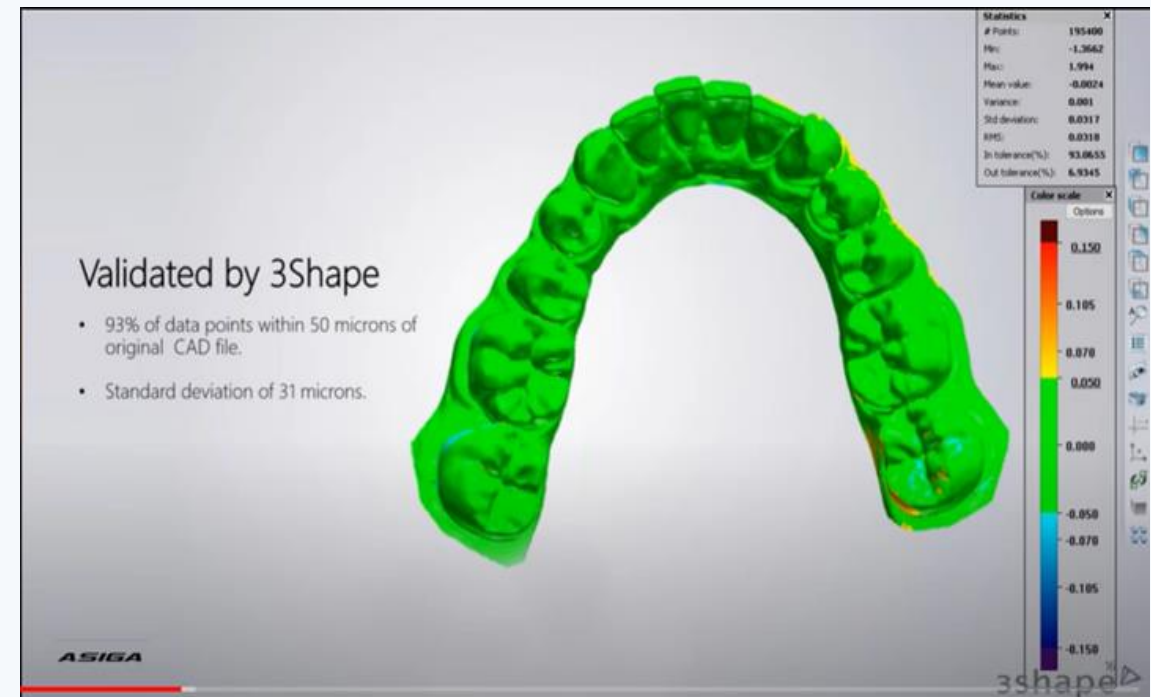
Source: Pixabay

### 3. DIGITAL TRANSFORMATIONS STUDY CASE #2: CROATIA

The vision

DENTAL MEDICINE CLINIC Dr STARČEVIĆ is a family-owned company in the field of dental medicine that, with its tradition of personalized work and high quality services, enters a new era of digital transformation and aesthetic surgery at a high world level.

The complete digital transformation of the dental practice promoted us to the world's top aesthetic dental surgery.



Source: Asiga

### 3. DIGITAL TRANSFORMATIONS STUDY CASE #2: CROATIA



The challenges that the company faced:

- new ways of doing business were sought by entering the field of aesthetic surgery,
- new technologies and new knowledge and new business processes
- high quality of service is requested
- a new fully personalized approach to clients is conditioned
- the hitherto mechanical approach and technology in aesthetic surgery did not allow rapid fingerprinting and rapid preparation of braces for dental corrosion
- lower level of precision of the footprint
- less adaptive braces that required a series of manual corrections
- discomforting process for the patient – service user
- visually inconvenient tooth insert and impractical when eating and drinking

### 3. DIGITAL TRANSFORMATIONS STUDY CASE #2: CROATIA

#### Benefits of Introducing Digitization into Business:

- The processes are absolutely accurate
- The processes require less time because they transmit the data digitally to technicians
- Digital imaging of the jaw is more comfortable for the patient
- The final product is impeccably accurate.
- The appliance is made of top quality materials, almost invisible and easy to use
- Ensured dry working environment which is challenging in dental surgery



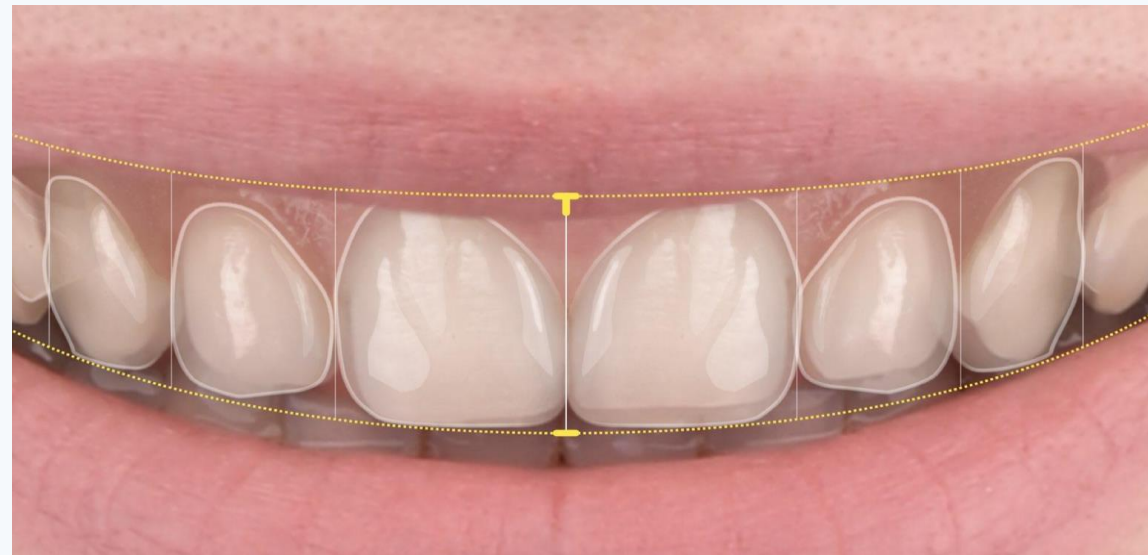
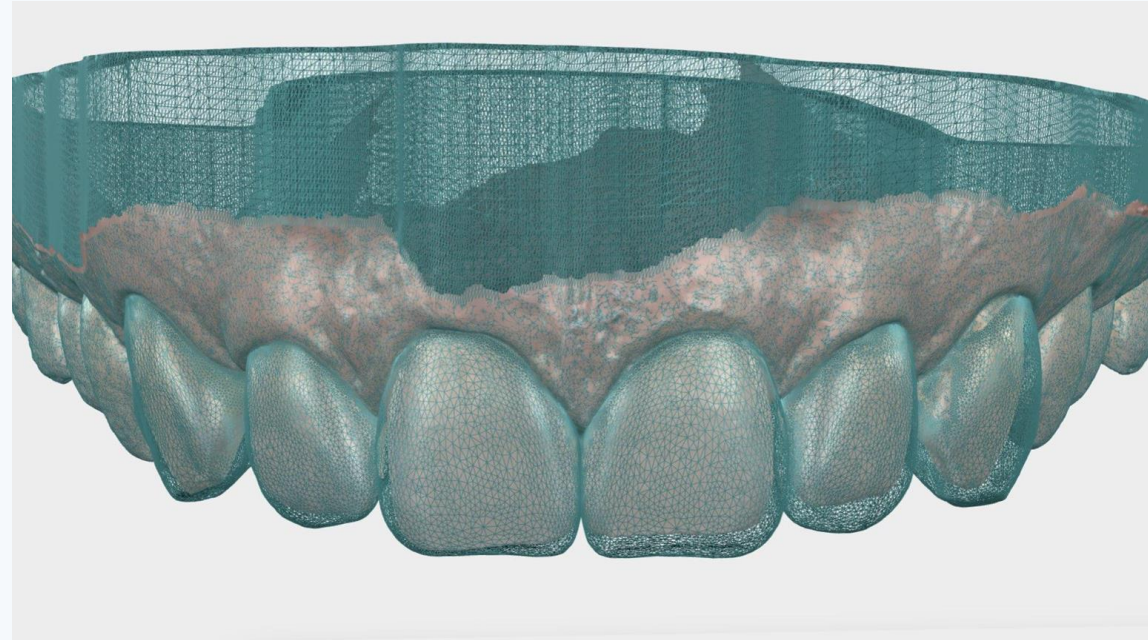
Source: Pixabay



### 3. DIGITAL TRANSFORMATIONS STUDY CASE #2: CROATIA

Key results of using digitization:

- Modern equipment for recording and digitization of content acquired
- Trained dentists and technicians to work with new technologies
- Production of digital recordings and photographs in full compliance with the model
- Secured transfer to technicians for the production of braces
- Digital production of appliances in full compliance with the model
- Established cooperation with Italian partners for digital production and delivery of braces
- Aesthetically high level of undetectability of braces
- Compliance of business and services with world-class achievements





### 3. DIGITAL TRANSFORMATIONS STUDY CASE #2: CROATIA

Barriers and bottlenecks in digital transformation process:

- High price of equipment for business digitalization
- Extra space for new equipment required
- Intensive employee training
- Additional hiring of specialists for digitalization and work with equipment
- There is sometimes a problem with the Internet speed
- Significant increase in the price of the service
- Key increase in the number of clients that would enable profitability of investments in digitalization of employment and return on investment
- Relatively low payment ability of the market



Source: Pixabay

### 3. DIGITAL TRANSFORMATIONS STUDY CASE #2: CROATIA

How to overcome the bottleneck:

- Additional employee education
- Additional expansion and development of business premises
- Stronger marketing
- Participation in international and domestic events and fairs of dental equipment
- Website and social media work with the presentation of user / patient experiences
- Appearance in specialized journals and in journals for the general public

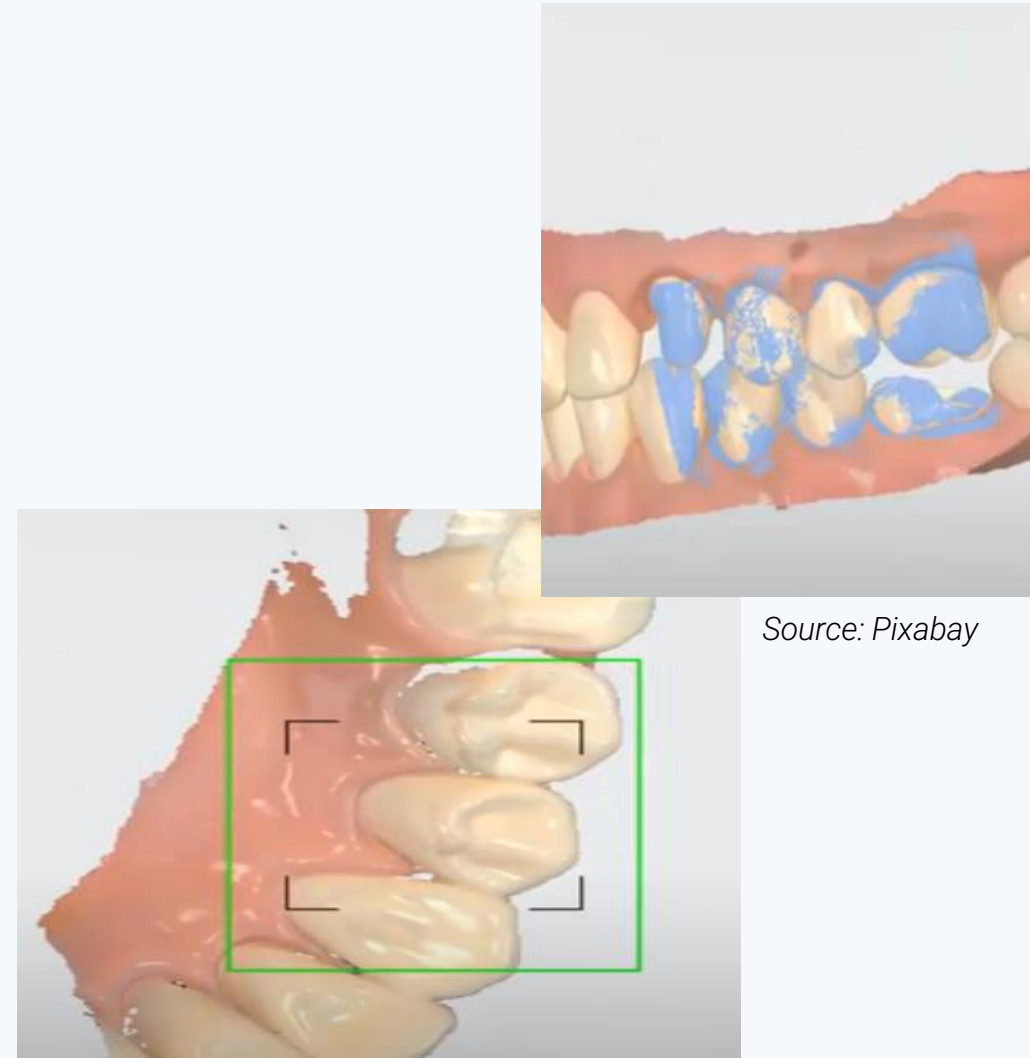


*Source: Pixabay*

### 3. DIGITAL TRANSFORMATIONS STUDY CASE #2: CROATIA

What did the digital transformation bring to the dental services?

- Improved dental services
- Entering the New Global Growing Area of Aesthetic Surgery
- Acceleration of the work process in the field of aesthetic surgery
- High quality of products and services (invisible braces and speed of service realization as a whole)
- Increased competitiveness
- Increased efficiency
- International business cooperation and networking
- Better trained staff, constantly updated on new technical trends
- Better cooperation and greater customer satisfaction with the service provided
- Personalisation of services
- New image of the dental practice as the center of contemporary aesthetic surgery in Croatia and the wider region



Source: Pixabay

### 3. DIGITAL TRANSFORMATIONS STUDY CASE #2: CROATIA

What is the future of the Dental Medicine Clinic Dr. Starčević?

- Further investments in digital transformation and technological progress to ensure faster and more enjoyable customer service
- Further education and strengthening of employees' knowledge
- Intensive international networking and knowledge transfer
- Increase in the number of users of aesthetic dental surgery based on intensive communication with the public
- Investing in promoting new services through social networks
- Expanding business - customer networks in the countries of the region



Source: Pixabay



### 3. DIGITAL TRANSFORMATIONS STUDY CASE #2: CROATIA

In your opinion, what would be the main risk of the company, had it not started the proces of transformation (think in terms of a competitive market)?

Would you think that being a family company helped or that it was a barrier in the process of transformation?

Would you say that the benefits gained outweigh the financial investments made?





## 4. DIGITAL TRANSFORMATIONS STUDY CASE #3: GERMANY

**Case #3:** Again, a company dedicated to support other companies in achieving digital transformation.

### **Suggested focus:**

We suggest you focus on the methodology they use to identify the challenges companies they are supporting face (especially in comparison with Case #1). Do they use the same methodology?

Also, note in which areas they provide services.

We suggest you look also at their best cases referred to in slide 46.



Source: Pixabay

## 4. DIGITAL TRANSFORMATIONS STUDY CASE #3: GERMANY

**Name of the company:** Nexum Corporation

**Year of establishment:** 2007

**Original core business:** Consulting and agency for communication, interaction and transaction in the digital age

**Current core business:** Consulting and agency for communication, interaction and transaction in the digital age



Source: <https://www.nexum.com/leistungen>

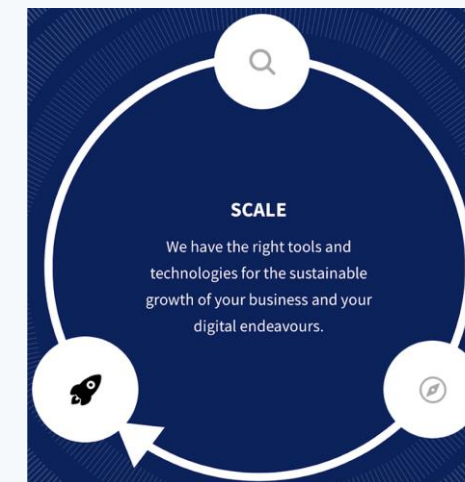
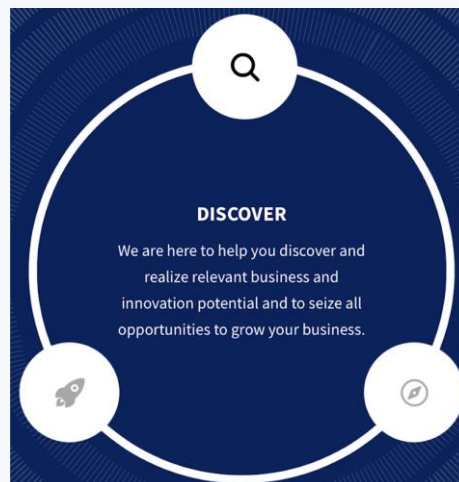


## 4. DIGITAL TRANSFORMATIONS STUDY CASE #3: GERMANY

Nexum cooperation is on the market since 2007. Their 250 employees work in Germany, Spain, the Netherlands and Switzerland. They have offices in Cologne, Hamburg, Munich, Nuremberg, Berne, Basel, Zurich and Valencia. Their shareholders are Board of Directors, Employees, Family & Friends.

They help people to master the challenges of digital transformation and set new standards. They help with strategy, UX, relevant technologies and methods, as well as with creativity and concentrated implementation power.

From Strategy to Data Intelligence they offer the full range of digital services.



Source: <https://www.nexum.com/leistungen>

## 4. DIGITAL TRANSFORMATIONS STUDY CASE #3: GERMANY

The company is supporting corporate social responsibility. Issues such as sustainability, education and culture are important to them because of a high proportion of parents and many young people among their employees. They bundle their digital expertise and support people and projects in their goals.

The challenges that companies face are:

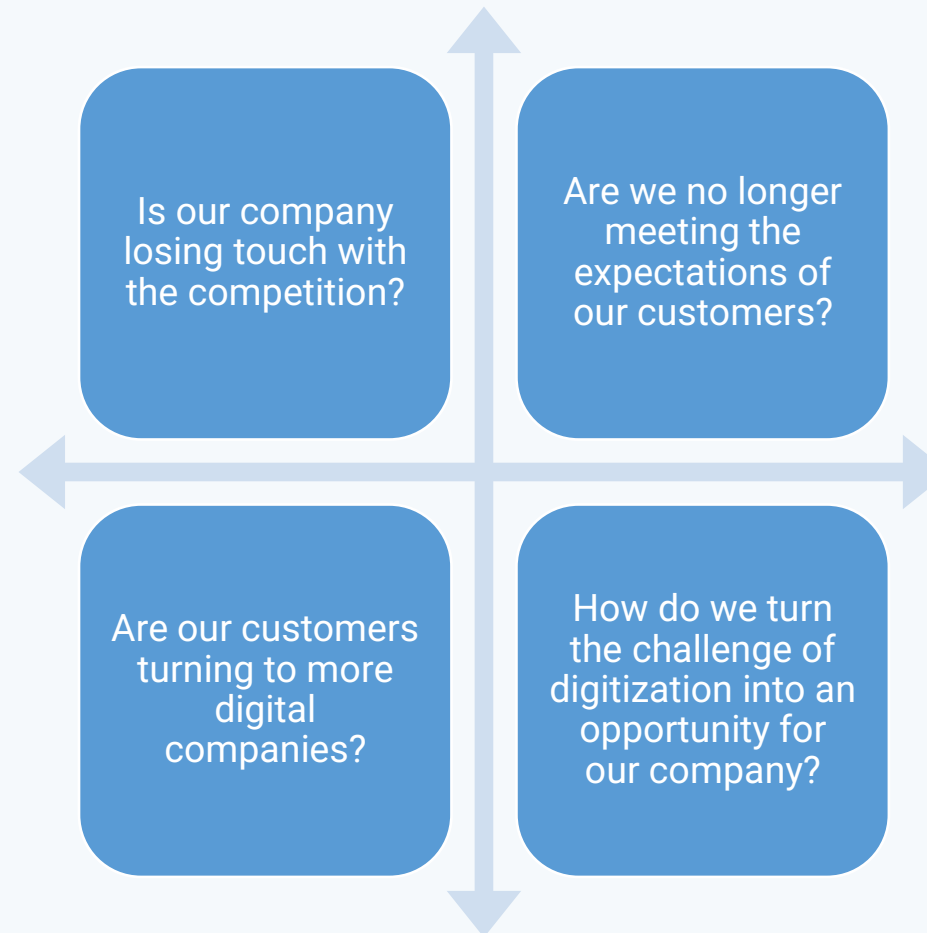
- Keeping up with the competition
- Meeting the expectations of their customers
- All digital - business models, digital platforms
- Turning the challenge of digitization into an opportunity for the company
- Rapidly changing technology and communication
- Predictions about future
- Constantly changing environmental influences and the resulting challenges



Source: <https://www.nexum.com/leistungen>

## 4. DIGITAL TRANSFORMATIONS STUDY CASE #3: GERMANY

They support people in digital transformation and build the bridge between the existing strengths of people's companies and the digital innovation that is important for people. Their consulting experts with digital expertise support people in strategy development and implementation.



Your Text Here

## 4. DIGITAL TRANSFORMATIONS STUDY CASE #3: GERMANY

Overview of their services:

- Strategy & Innovation
- Digital Communication & Media
- Websites & Experience Platforms
- Commerce Solutions
- Data Intelligence & CRM
- Software Architecture & Operation
- Digital Business & Company Building



Source: <https://www.nexum.com/employer-branding-digitaless-personalmarketing>

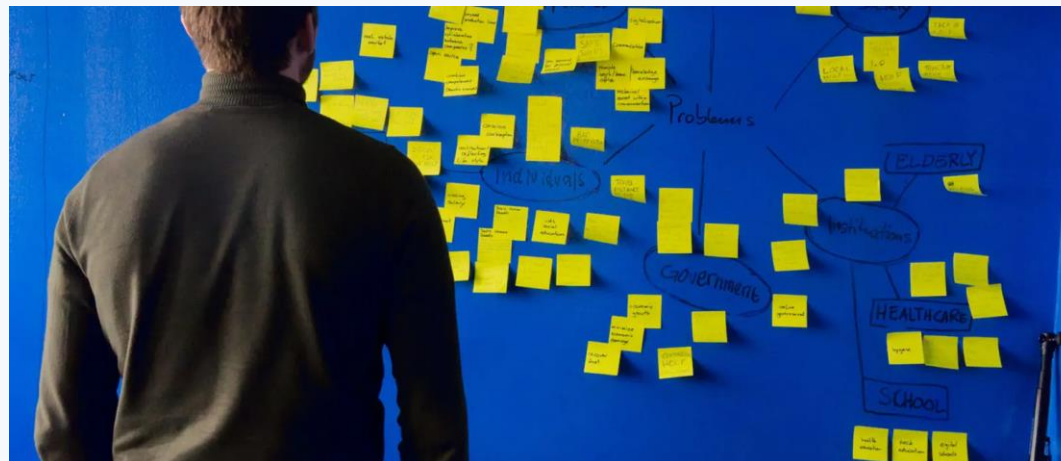
## 4. DIGITAL TRANSFORMATIONS STUDY CASE #3: GERMANY

In the field **Strategy & Innovation**, they develop strategies on:

- Innovation and brainstorming
- Technology Consulting
- Business Intelligence & Analysis
- Customer Experience Management
- Business Model Assessment

In the field **Consulting and Agency for websites & platforms**,

- they develop strategies on:
- Websites
- Campaign landing pages
- HR Marketing & Employer Branding
- Platforms
- Business Applications



Source: <https://www.nexum.com/leistungen/strategie-innovation-beratung>

## 4. DIGITAL TRANSFORMATIONS STUDY CASE #3: GERMANY

In the field **E-commerce consulting and agency**, they develop strategies on:

- E-commerce platforms
- Online stores
- Omnichannel solutions
- Social Commerce & Live Commerce

In the field **Online marketing and social media agency**,

- they develop strategies on:
- Social media and community management
- Brand & performance campaign management
- Digital branding, employer branding
- Social & display advertising
- SEO/SEA
- Data analysis & reporting



Source: <https://www.nexum.com/leistungen/digital-communication-social-media-agentur>



## 4. DIGITAL TRANSFORMATIONS STUDY CASE #3: GERMANY

In the field **Data Intelligence & CRM**, they develop strategies on:

- Personalization and Recommendation Engines
- Data and web analytics & optimization
- Customer Relationship Management (CRM)
- Customer Service & Marketing Automation
- Conversion Optimization



Source: <https://www.nexum.com/leistungen/data-intelligence-crm>

In the field **Software Architecture & Technology Consulting**, they develop strategies on:

- Solution architecture
- Platform as a service
- Cloud solutions
- CMS and headless CMS
- Managed services
- Data integration



Source: <https://www.nexum.com/leistungen/software-architecture-operation>



## 4. DIGITAL TRANSFORMATIONS STUDY CASE #3: GERMANY

There are several steps for developing a digital strategy that they apply:

- Phase 1: Idea generation & modelling

Together with the company they discover innovative business ideas and transform the company into viable (digital) business models with the help of a value proposition.

- Phase 2: Development & Validation

Together with the company, they create an environment in which they can validate and refine the company's new business model using lean principles until your (future) customers love the company's products. Through an MVP (Minimum Viable Product) approach, they minimize the risks and enable a minimal "Time to Market".

- Phase 3: Roll-out & Growth

Together with the company they establish scalable structures for the company and strategically develop their products to grow in the market in the long term.

## 4. DIGITAL TRANSFORMATIONS STUDY CASE #3: GERMANY

### A new website for Cassini Consulting AG

Example of obstacles of the company Cassini Consulting AG which was supported by Nexum corporation:

Cassini Consulting AG is an enabler of digital transformation in Germany. A company that transforms knowledge into effective competitive advantages for clients. Their new website therefore had to be technically leading, clear in design and content, with the consistent claim of knowledge leadership. Nexum tackled this challenge.

The steps of the challenge were:

- Show knowledge and make it shareable
- Leading the way technically
- A design according to plan
- A successful integration



Source: <https://www.nexum.com/cases/cassini>

## 4. DIGITAL TRANSFORMATIONS STUDY CASE #3: GERMANY

In a comprehensive and intensive relaunch process, Nexum used Prismic as a modern headless CMS and built on it to develop a modern, clear and eye-catching design using the React framework. Based on the idea of thought leadership, Nexum designed a website that conveys the in-depth knowledge that makes Cassini special, in terms of content on every page and in different formats.



Source: <https://www.nexum.com/leistungen/websites-plattformen>

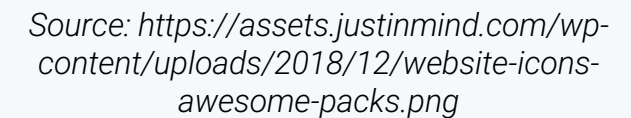
## 4. DIGITAL TRANSFORMATIONS STUDY CASE #3: GERMANY

What strategies did nexum use for Cassini to achieve a technically state-of-the-art website, clear in design and content with a constant claim to knowledge leadership?

- The conception of the entire appearance, and establishment of a general website strategy.
- A modern design that extends the company's identity into the digital realm.
- Creation of a photo vision to implement likeable and personal employee photos.
- Improving user navigation and storytelling by introducing chapters and color eye-catchers.
- Developing the website using the cloud-based headless CMS Prismic.io and the React framework.
- Setting the tone and creating content with subsequent maintenance and editorial training.



"Cassini is one of the thought leaders in digital transformation. Our clients know this, too, and we transform knowledge into real competitive advantages for them. Our new website is the digital home port for everything we make possible: From mid-market digital to startups to digital products and services." André Stebens, CEO der Cassini Consulting AG



## 4. DIGITAL TRANSFORMATIONS STUDY CASE #3: GERMANY



### **Conclusion:**

The new website offers the possibility to create content for different target groups in an integrated way and via only one CMS. This can then be played out automatically at different points in the Cassini presence. Already in the conception phase, care was taken to ensure that content can be shared without hurdles. Perfect playout in social media is also guaranteed. If you know a lot, you can inspire a lot of people to pass on content. The best form of communication is person-to-person.

Cassini was given the opportunity to prepare their topics using well thought-out templates and tools so that they can tell stories and inspire people. Away from the sober press release, towards storytelling and conveying.

Nexum claims that with the new website customers as well as applicants of Cassini can look forward to fast and personalized communication. With the connection of maatoo, a marketing automation tool, target group-specific content, for example on the application process, can be communicated quickly and automatically.

## 4. DIGITAL TRANSFORMATIONS STUDY CASE #3: GERMANY

According to Nexum the implementation via headless approach offers many advantages: Separation of front-end and back-end, resulting in high flexibility, but also the possibility to play content on different ways and even different output systems. A win-win for users, marketing and IT alike. An approach that carries the claim to keep the backend of a website modern for years while maintaining maximum flexibility.

This is an important point for Cassini, as the dynamics of the market through digital business models and innovative technologies require maximum flexibility and agility. At the same time, the headless CMS offers maximum security, as all content is stored correctly, stably and securely in a central data pool.



Source: <https://imptrax.com/blog/marketing-as-a-win-win-proposition>



## 4. DIGITAL TRANSFORMATIONS STUDY CASE #3: GERMANY

### Some other best practices:

- Best practice 2 from Nexum: [Pflanzen, pflegen, ernten: compo.de erblüht in neuem Look] <https://www.nexum.com/cases/case-compo>
- Best practice 3 from Nexum: [NKT - Kraftvolle Technologie für den Marken-Relaunch] <https://www.nexum.com/cases/website-relaunch-mit-power-im-backend-nkt>
- Best practice 4 from Nexum : [Relaunch der apoBank Karriere-Website] <https://www.nexum.com/cases/apobank-karriere-website>
- Best practice 5 from Nexum: [Website, Shop und Digital Campaigning für Avoury] <https://www.nexum.com/cases/avoury-website-shop-digital-campaigning>
- Best practice 6 from Nexum: [1. FC Köln: Optimierung der Customer Experience auf Basis von Salesforce] <https://www.nexum.com/cases/fc-koeln-salesforce>

## 4. DIGITAL TRANSFORMATIONS STUDY CASE #3: GERMANY

Comparing case #1 and case #3, which of these two supporting companies would be more suited to support the case #2 (dental company)? Why?

As both companies of case #1 and case #3 are successful in their own environment, how come they can both have a different approach, but still be good at supporting other companies in their transformation?

Comparing both SWAT analysis tools, would you say that company in case #3 is more specific focused?



## 5. DIGITAL TRANSFORMATIONS STUDY CASE #4: POLAND

**Case #4:** a company providing IT solutions for other companies who want to digitalize.

### **Suggested focus:**

Which digital tools are provided?

Which services for the companies do they develop?

Which are the elements (technological or otherwise) that help improve customer experience?



Source: Pixabay

## 5. DIGITAL TRANSFORMATIONS STUDY CASE #4: POLAND



### **Cloud Solutions SAP and Microsoft experienced partner**

For several years now being a technological partner of its customers, Apollogic has been focusing on cloud solutions. The technologies based on cloud infrastructure provide added value in terms of flexibility, easier expansion or simplification of internal IT departments.

As a long-term SAP and Microsoft partner, we offer support in consulting, implementation and management of various cloud solutions within nearly every business area.

## 5. DIGITAL TRANSFORMATIONS STUDY CASE #4: POLAND



*Current business objectives of our clients, related to the strategy of digital transformation, face challenges that can only be achieved using modern cloud solutions. This is related, on the one hand, with the enormous amount of data that these companies generate in their disparate business systems - already counted in peta bytes - and, on the other hand, with the expectations of anticipating key indicators in real time. The offer of services that we provide in the area of cloud computing, Internet of Things and Artificial Intelligence has been prepared together with our partners so that every enterprise could benefit from the dynamic development of these solutions and succeed in the process of industrialization 4.0.*

Andrzej Brodniewicz, Chief Technology Officer

# 5. DIGITAL TRANSFORMATIONS STUDY CASE #4: POLAND

## Cloud Solutions:



# Digital transformation of your business

[Cloud solutions](#)
[Business applications](#)
[Industry 4.0](#)
[Improve competitiveness](#)
[Increase revenues](#)
[Generate savings](#)
[About us](#)




### Business applications

Choose intelligent solutions to better respond to your customers' needs and automate processes in your company.

More details ▶



### Microsoft Power Platform

Visualize data, create low-code applications, automate workflows and build intelligent chatbots using a powerful platform.

More details ▶



### Microsoft Azure

Use the potential of the world's most popular cloud provider and move your business to the cloud.

More details ▶



### Microsoft Modern Workplace

Everything you need to work efficiently and comfortably. No matter the device you are using or where you are working from.

More details ▶



## 5. DIGITAL TRANSFORMATIONS STUDY CASE #4: POLAND

### Business applications:



## Digital transformation of your business

Cloud solutions | **Business applications** | Industry 4.0 | Improve competitiveness | Increase revenues | Generate savings | About us | 

### Our offer



#### Web applications

We develop stand-alone mobile and desktop solutions, custom tools that integrate with SAP and Microsoft software, as well as low-code and no-code applications.

[Read more](#)



#### Cloud services

We deliver Microsoft Azure and Amazon Web Services cloud solutions and provide a full range of services from technology consulting, architecture design, software development to migration.

[Read more](#)



#### IT systems integration

We streamline business processes and accelerate workflows by connecting IT systems and applications or integrating the external solution into the company's IT architecture.

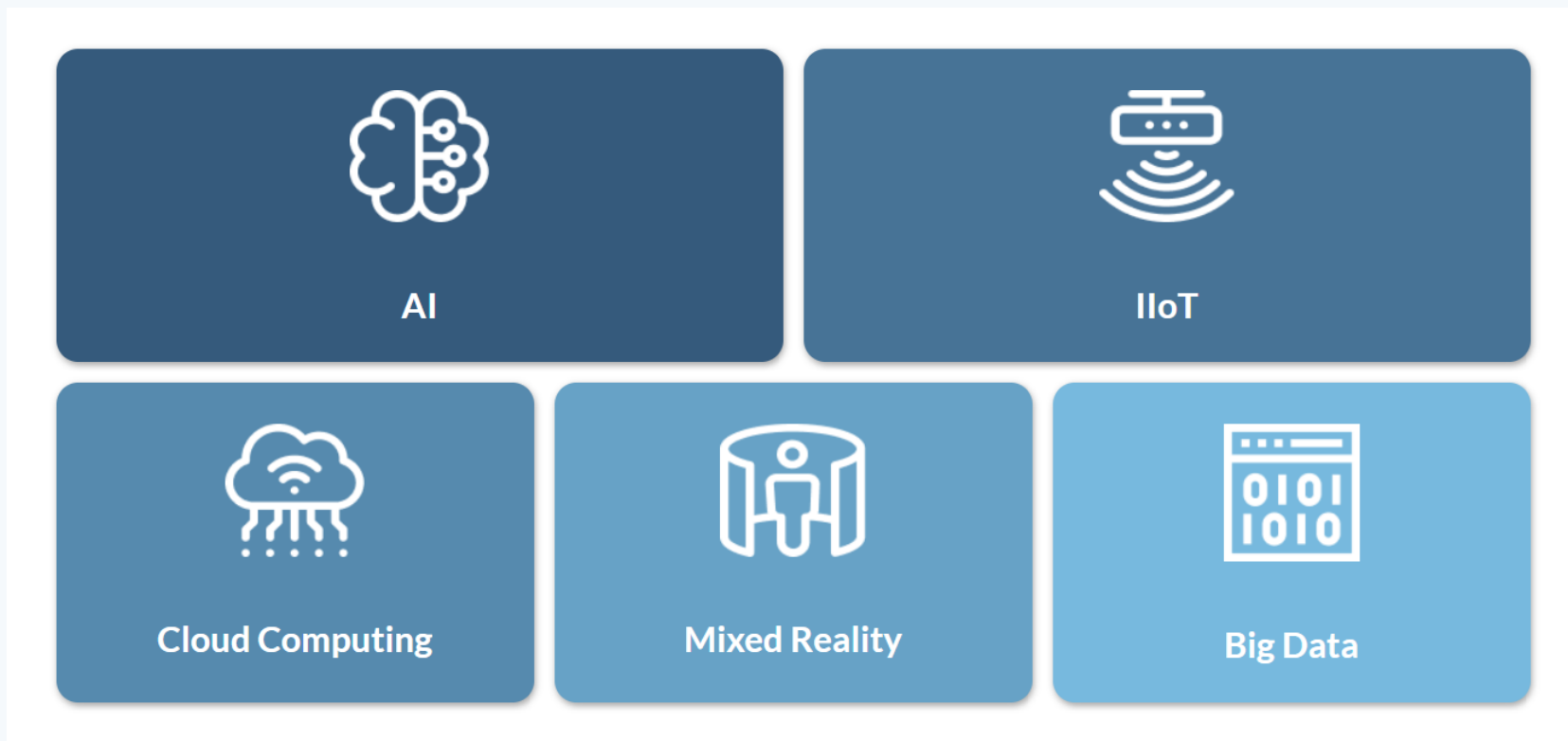
[Read more](#)



## 5. DIGITAL TRANSFORMATIONS STUDY CASE #4: POLAND

Industry 4.0 means a transition from a traditional to a smart factory model, mainly through automation of processes, Internet of Things solutions, AI algorithms, connectivity, and data analysis. By using modern technologies, you can reduce costs and increase the efficiency of production processes while improving the quality of manufactured goods.

<https://apollogic.com/>



Here

## 5. DIGITAL TRANSFORMATIONS STUDY CASE #4: POLAND

### **Help in improving competitiveness**

The need to adapt operations to the evolving business environment, dynamically changing customer requirements and the growing employee-centric culture mean that modern organizations must constantly strive to gain a competitive advantage. Improvement is most quickly achieved through internal and external process optimization and automation. As an experienced technology partner Apollogic can identify areas of your organization that have the greatest potential to implement changes resulting in increased competitiveness.

### **AI and IoT-driven process automation**

In every organization, there are a number of activities and tasks performed manually every day that can be successfully automated. Using IoT-based solutions you will speed up key processes while reducing human intervention, cutting labor costs and minimizing the risk of errors. Additional support in the form of artificial intelligence algorithms will allow you to constantly improve operations, predict potential failures or eliminate the negative effects of breakdowns and downtime.

### **Factory of the future**

Companies looking to take advantage of the latest digital transformation solutions can benefit from a technology audit to determine the level of digital maturity of the enterprise and build a roadmap with recommended solutions and the benefits achievable through their use. By working with an experienced partner, you can easily move your factory into the era of Industry 4.0 and discover the vast possibilities it offers.

## 5. DIGITAL TRANSFORMATIONS STUDY CASE #4: POLAND



### **Low-code & no-code development**

In order to accelerate business processes and automate time-consuming activities, it is not necessary to implement a complex IT system and spend many months building the appropriate software. There is an increasing interest in applications built from ready predefined elements, which in combination with the Microsoft Azure environment facilitate workflows and allow you to extend the functionality of the existing solutions.

### **Better customer service**

Growing competition, dynamic technological development and changes in buyers' behavior present companies with new challenges. Today's consumers have many expectations from brands, counting on immediate response to their needs and individual approach to each request. Companies with thousands of customers can benefit from the support of systems optimizing customer service. Thanks to built-in mechanisms of artificial intelligence and easy integration with other tools they can solve the most frequently encountered problems, and in case of lack of data – they will redirect the request to the appropriate consultant.

## 5. DIGITAL TRANSFORMATIONS STUDY CASE #4: POLAND

### Better visibility for your products

The availability of the right product at the time a customer makes a purchase decision is critical to sales success. Changing purchasing behaviors and decreasing customer loyalty are driving organizations to maximize product visibility on the store shelf. By leveraging digital tools, sales managers can differentiate their brand's offerings from the competition and get shoppers to reach for their products more often.



Source: Pixabay

## 5. DIGITAL TRANSFORMATIONS STUDY CASE #4: POLAND

### The example of accomplish project:

#### SAP Fiori and SSO implementation in Animex

Customer: Animex

Sector: food

Area: shopping

Work scope: application implementation

This application reduces a series of activities which extended the work time of the Shopping Department employees, such as completing transactions

The implementation of the SSO mechanism based on X.509 certificates allows for effective logging in given applications. This mechanism assumes that after generating customers' certificates with embedded, e.g., users' names, given certificates are signed by the Authorisation Centre for the purpose of the subsequent verification of the certificate authenticity.

[Read more](#)

## 5. DIGITAL TRANSFORMATIONS STUDY CASE #4: POLAND

The company provides IT support, but does that mean that all services for the customer will get digitalized?

How do you understand the quality of customer experience?

How can digitalization simplify and lower the costs of some processes within a company?



## 6. DIGITAL TRANSFORMATIONS STUDY CASE #5: SPAIN

**Case #5:** The following company is producing sofa's. They needed to find a way to adopt to new customer demands.

### **Suggested focus:**

Look at the SWOT analysis, especially the correlation between the company's weaknesses (top left) and threats to the company (top right) in slide 63.

Examine the barriers faced in the process of digitalization.

What was the impact of the changes on the company?



*Source: Pixabay*



## 6. DIGITAL TRANSFORMATIONS STUDY CASE #5: SPAIN

**Name of the company:** Fama Sofás, S.L.

**Year of establishment:** 1971

**Original core business (before transformation):** upholstered furniture manufacturer

**Current core business (what they do now):** upholstered furniture manufacturer



## 6. DIGITAL TRANSFORMATIONS STUDY CASE #5: SPAIN

Fama is one of Spain's leading sofa companies. Founded in 1971, today it has become one of the most technologically advanced sofa manufacturers in the world.

With two production plant of more than 20,000 m<sup>2</sup> each, where it carries out the complete production process, fusing design, technology and craftsmanship in a perfect way.

It currently produces more than 500 sofas a day (one sofa every 1.5 minutes). It has 250 highly qualified direct employees.



Source: FAMA

## 6. DIGITAL TRANSFORMATIONS STUDY CASE #5: SPAIN

The challenges that the company faced in the past were:

- To be able to develop new product projects efficiently (economically and in terms of time).
- To be able to create full-size prototypes directly in the facilities, without depending on third parties.
- To have the appropriate technical knowledge in the technical office to be able to integrate new technologies.
- Assisting customers in their demand to be able to visualise their sofa in their home, as well as being able to personalise it.
- Improving productivity by automating key processes in the production chain: cutting and packaging and partially automating the following ones: sewing, upholstery and sheathing.

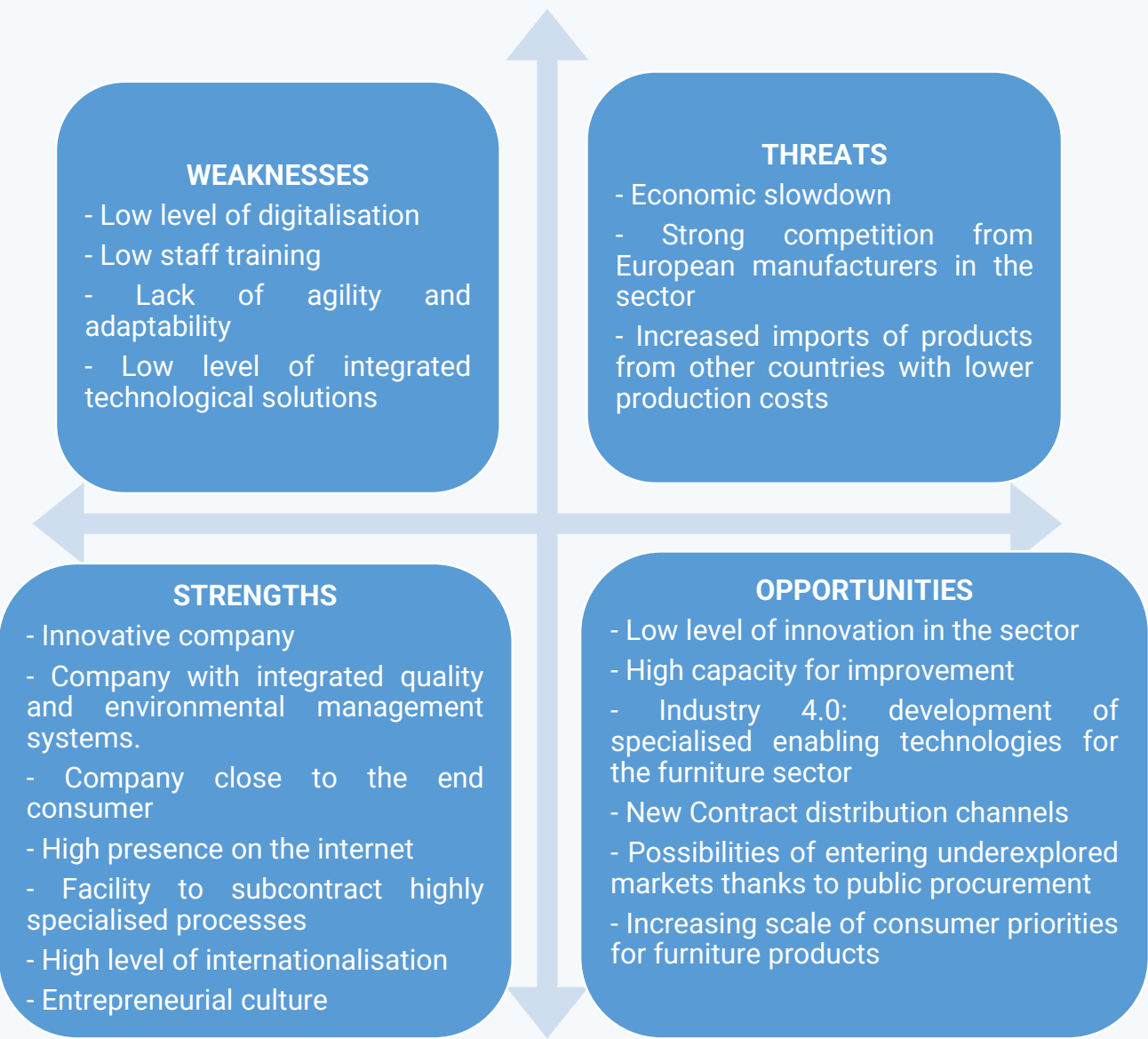


Source: Freepik

# 6. DIGITAL TRANSFORMATIONS STUDY CASE #5: SPAIN

In order to analyse what the problem and opportunities were for FAMA to carry out its digital transformation, a SWOT analysis was carried out.

It can be seen that the opportunities and strengths are greater than the negative points identified, which all pointed to the fact that the change FAMA evaluated would be positive.



## 6. DIGITAL TRANSFORMATIONS STUDY CASE #5: SPAIN

### The FAMA's vision

FAMA carries out the complete production process, from design to after-sales service and, in order to increase the number of sales, they needed to improve the efficiency and productivity of the company. The company's vision was to continue growing and for this they were aware of the need for a technological improvement of their business model. The continuous evolution of the company, accompanied by innovations, would allow them to keep pace with the company and the prestige it was gaining in the market.

It was clear to them that the complete digital transformation of the company was key, always with a well-designed and planned strategy with different actions.



Source: Freepik

## 6. DIGITAL TRANSFORMATIONS STUDY CASE #5: SPAIN

There are several steps that FAMA carried out for the implementation of its digital transformation:

- Definition of a technological roadmap within its business model, as well as an action plan, which in turn differentiates itself from the competition.
- Contact with external suppliers and experts in the adoption of 4.0 technologies (e.g., technology centres).
- Corporate cultural change to give more importance to the technological part also within the production process and the business model.
- Establish training plans adapted to each position and according to the measures implemented.
- Recruit personnel specialised in digitalisation and transformation.
- Acquisition of machinery related to the new technologies selected.



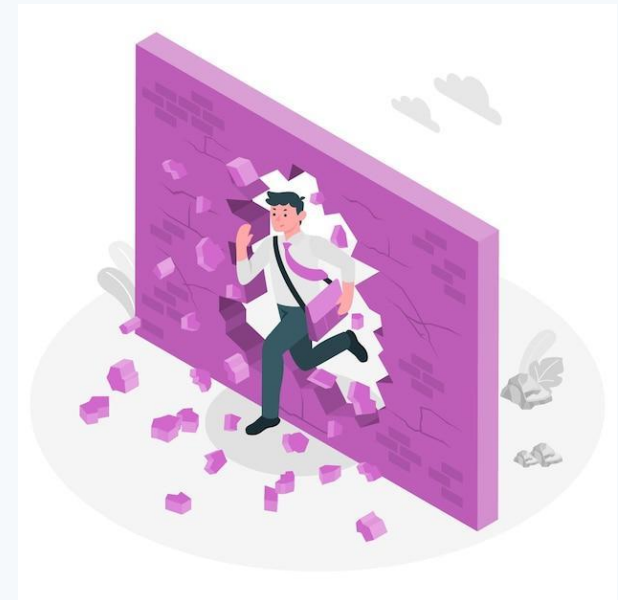
*Source: Freepik*

## 6. DIGITAL TRANSFORMATIONS STUDY CASE #5: SPAIN

### What were the barriers they faced?

Some difficulties encountered in the digital transformation of the company are:

- Limitations in the effective adaptation of technologies in the company, due to its way of working and its operational flows.
- Appearance of new needs to be covered during the implementation of new technologies.
- Achieving that customised developments were fully operational and functional.
- Lack of capacity to define all the needs to be covered.
- Investment made in the short term.
- Operability of the company after the adoption of the new technologies.
- Technical capacity of the staff, mainly in production.



Source: Freepik



## 6. DIGITAL TRANSFORMATIONS STUDY CASE #5: SPAIN

### How did they overcome the barriers?

FAMA always works with a risk and contingency plan based on the Crawford Slip method, trying to identify the risk, its possible consequences and a mitigation plan in advance. In any case, the difficulties identified in the digital transformation of the company were addressed as follows:

- Training of workers on new technologies, as well as any changes in the software and hardware used.
- Fluid communication between the leader and the workers.
- Regular meetings with workers (global and departmental) to communicate the changes to be made, look for points of improvement, solutions to problems caused by the transformation, etc.
- Carrying out many pilot tests of the operation of the new technologies implemented.
- Periodic review of key production parameters to evaluate the implementation of new technologies.
- Search for public aid to mitigate the internal private investment made.



Source: Freepik

## 6. DIGITAL TRANSFORMATIONS STUDY CASE #5: SPAIN

### What did the transformation bring to the company (what changed)?

The company's technology and bionic transformation roadmap has been part of its business strategy for years, and this has been reflected in the achievement of the following milestones:

- Improved productivity index.
- Increased production volume with the same resources.
- Transcendental reduction of intermediate warehouses.
- Elimination of processes that add no value.
- Innovation of the key processes themselves, improving times.
- Substantial improvement in the service provided.
- Increased competitiveness.
- Increased efficiency.
- Connection of the chain's processes.
- Access, in real time, to the status of orders.
- Collaborative development
- Better trained staff, constantly updated on new technical trends.
- Reduction of incidents.
- More direct connection with customer needs.
- Personalisation of products.



Source: Freepik

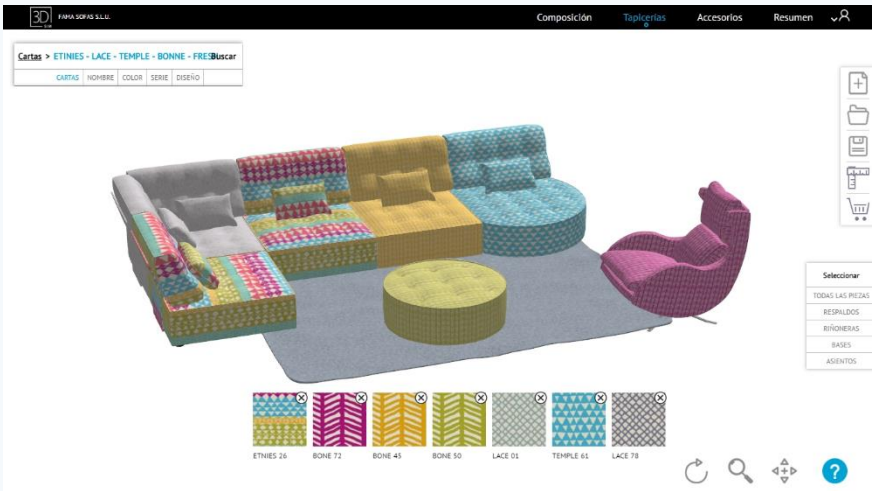
# 6. DIGITAL TRANSFORMATIONS STUDY CASE #5: SPAIN

## What is the company known for now?

FAMA is the perfect combination of tradition and innovation. The company is a clear example of constancy, hard work and sustainability. The company carries out the complete production process, from design to after-sales service. They fuse the most advanced technologies with the wisdom and expert hands of the upholsterers' craftsmen.

The company is known for the constant technological innovation of its brand. Every year it develops new products and every day it launches an average of 5 small innovations. In addition to the 5 small innovations per day, the company always has around 50-60 larger innovation projects open. Thus, new utility models, designs and patents are registered every year. This has allowed the company to gain notoriety and the brand (Fama Sofas) to be known by a large number of people in different countries.

This is also due to the creation of a product that is different from market trends, characterised by the use of curved shapes, the use of exclusive upholstery with exceptional colouring and, above all, conformity and functionality.



Source: Fama

## 6. DIGITAL TRANSFORMATIONS STUDY CASE #5: SPAIN

### How has the change impacted the management, the staff and the customers?

The digital transformation has not only had an impact on the company's production, but also on its leadership and its employees. FAMA has a Technical Office, with an ever-growing workforce that is constantly working on the creation of new projects. This department is equipped with the most modern computer tools, as well as 4.0 machinery such as real size 3D printers.

In addition, its customer relations have improved significantly, thanks to the increased quality of the products at a competitive price. On the other hand, product customisation, 3D design programmes and the creation of virtual renders have greatly improved the customer experience.

At the management level, its CEO has managed to take the company to a new stage by investing in technology and human capital at the same time. All this has allowed him to have more information about his business and to know perfectly the weaknesses that he struggles to improve continuously.



*Source: Freepik*

## 6. DIGITAL TRANSFORMATIONS STUDY CASE #5: SPAIN

### What are the predictions for the future for the company?

The figures speak for themselves:

- More than 30 million euros annual turnover.
- Exports to more than 70 countries (80% of its production).
- Constant increase in the number of direct employees.
- More than 100 indirect workers.
- A new facility was built during this year and thank to this enlargement; they have reached almost the double capacity in terms of production.

FAMA will continue as before, being a company defined by the adjectives of leadership, technological innovation and continuous improvement, therefore it will continue to work on new objectives for its technological and business route, supported by an excellent leadership and its efficient staff.



Source: Freepik

Your Text Here

## 6. DIGITAL TRANSFORMATIONS STUDY CASE #5: SPAIN

Which part of the working process changed in the company (did they start producing something new, were they producing the same thing but in a different way) and how did they change?

Were there many barriers in the process of transformation? Why?

How did the transformation reflect in the future plans of the company?



## 7. DIGITAL TRANSFORMATIONS STUDY CASE #6: BELGIUM

**Case #6:** The following company was selling drawer parts for a manufacturer. They transformed their business into drawer production instead.

### **Suggested focus:**

Why did the company decide to change their business?

How was the mass customisation achieved?

What were the benefits of the transformation?



Source: Pixabay



## 7. DIGITAL TRANSFORMATIONS STUDY CASE #6: BELGIUM

**Name of the company:** Van Hoescke NV

**Year of establishment:** 1967

**Original core business:** A commercial company that sold the components of the drawer systems of the Austrian manufacturer Blum exclusively in the Benelux.

**Current core business:** Since 2014 Van Hoescke has marketed its own industrially-made wooden drawer system under the brand TA'OR.



Source: [vanhoecke.be](http://vanhoecke.be)

Your Text Here

## 7. DIGITAL TRANSFORMATIONS STUDY CASE #6: BELGIUM

### Description of company's history:

The Belgian family company Van Hoecke, based in Sint-Niklaas, has been a partner to the furniture industry since 1967. As a distributor of hinges, lift systems and drawer systems for the Austrian brand Blum for kitchen and interior builders, they have been the market leader for years. In addition, with ORGALUX, they have created an in-house brand of inner divider systems and kitchen aids. Since 2014, Van Hoecke has marketed its own industrially-made wooden drawer system, under the brand TA'OR. With its in-house brands, Van Hoecke is looking further afield than the Benelux, and is already exporting to Switzerland, France, Germany, the United Kingdom and Israel. Thanks to the commitment of its 220 dedicated employees, and ongoing investment in technology and automation, the company is growing year after year.



**We continue to develop as a company, but our values remain the same.**

Behind everything we do, there is a well-thought-out plan - and a team of committed employees who are passionate about putting strategies into action. This is how we continue to excite our customers. We keep our promises. We pass on our knowledge. And we say what we think. Especially when things gets a bit difficult.

|                                                                                               |                                                                                                                                                            |                                                                                                                                                                   |                                                                                                                                                    |                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>1967</b><br/>We set up the company Van Hoecke as a merchant for furniture fittings.</p> | <p><b>1973</b><br/>We use the opportunity to offer our industry and trade customers fittings by <b>Blum</b> – as exclusive distributor in the Benelux.</p> | <p><b>2001</b><br/>We also offer Blum inner compartment systems in sets, which facilitates the sale – and which inspires to look at the brand <b>ORGALUX</b>.</p> | <p><b>2012</b><br/>Grown from the desire to grow further, <b>TA'OR</b>. The box system provides users of Blum fittings with new opportunities.</p> | <p><b>2017</b><br/>We celebrate our 50th anniversary and establish <b>Van Hoecke</b> as its own brand which sells Blum, ORGALUX and TA'OR and offers an international service.</p> |
|          |                                                                       |                                                                              |                                                               |                                                                                                                                                                                    |

Source: [vanhoecke.be](http://vanhoecke.be)

Your Text Here

## 7. DIGITAL TRANSFORMATIONS STUDY CASE #6: BELGIUM

### Challenges the company was facing before transformation:

The company strives for continuity across the generations through constant growth in both turnover and margin. With a share of 80%, they are the market leader in the regional market.

However, according to economic laws, this means that they are almost at the ceiling of their possibilities. Van Hoecke asked themselves:

How was Van Hoecke able to offer "mass customization" to its customers in Belgium?

To further guarantee growth, Van Hoecke has taken the step from dealer/distributor to assembler and finally to producer.



Source: [vanhoecke.be](http://vanhoecke.be)



## 7. DIGITAL TRANSFORMATIONS STUDY CASE #6: BELGIUM

### The vision, what did they want to change and how

Robotization, automation and digital technological innovation were central to their transformation process, at the service of the customer, the staff and the product.

They started to specialize in customized wooden drawers, based on their know-how of producing metal drawers. TA'OR or 'The Art of Organizing' was born.

Van Hoecke wanted to produce demand-driven and tailored to the individual end customer, while at the same time guaranteeing the shortest possible delivery times to his direct customers, usually carpenters.

To realize this, he decided to digitize his factory. For example, customers can enter and change orders themselves and personalize products. In the meantime, man and machine work hand in hand in the factory to mass-produce personalized products.



Source: [vanhoecke.be](http://vanhoecke.be)

## 7. DIGITAL TRANSFORMATIONS STUDY CASE #6: BELGIUM



### **What steps did they undertake, to make the change:**

- To digitally capture the wishes of the end customer, the 'Van Hoecke online configurator' is used. This web-based communication system controls the full complexity of the offer and then controls the entire production flow from machine to machine. The production schedule is tailored to the digitally incoming orders and the available production capacity, taking energy and waste efficiency into account.
- The robots in the production process are constantly fed with digital data, in order to allow them to be produced more intelligently. This communication is made possible by providing the semi-finished products with RFIDs (Radio frequency identification) during the production process.
- The operator's role in this highly adaptive production has evolved from an executive to a process-monitoring function within a self-managing team. This means that operators within the team organize their work completely independently daily.
- How did this happen? By taking a long-term view, with a strong commitment from all employees and the desire to take the burden off the customer. But what really makes all the difference is the willingness to innovate in all areas of the company.

## 7. DIGITAL TRANSFORMATIONS STUDY CASE #6: BELGIUM

### What were the barriers they faced?

According to Steven Muylaert, hoecke, we would only arrive at a Lean strategy if the change also came through our workers, which we started to do in the production department.

Everything was done gradually, through workshops and joint learning of new responsibilities and skills. We started standing meetings at the beginning of each shift. This new approach went hand in hand with an investment in ergonomics and we started to fully personalise our workstations, with a significant contribution from all the workers.”



Source: Agoria.be

## 7. DIGITAL TRANSFORMATIONS STUDY CASE #6: BELGIUM

### How did they overcome the barriers?

In order to break away from the old form of leadership, all team leaders had to adapt on a personal level.

They wanted to involve everyone in the vision of our company's future, not just the team leaders. That is why the company decided to launch the 'Hello You' participation project, as part of which they invited every employee to answer two questions: 'What would you absolutely want if we were to move towards greater autonomy?' and 'What would you absolutely want to avoid if we were to move towards greater autonomy?' It was an unprecedented success. We were able to target important expectations, such as the clarification of our sub-strategies and the need for flexibility in all possible areas: working hours, workplace, wages, work content, and more.



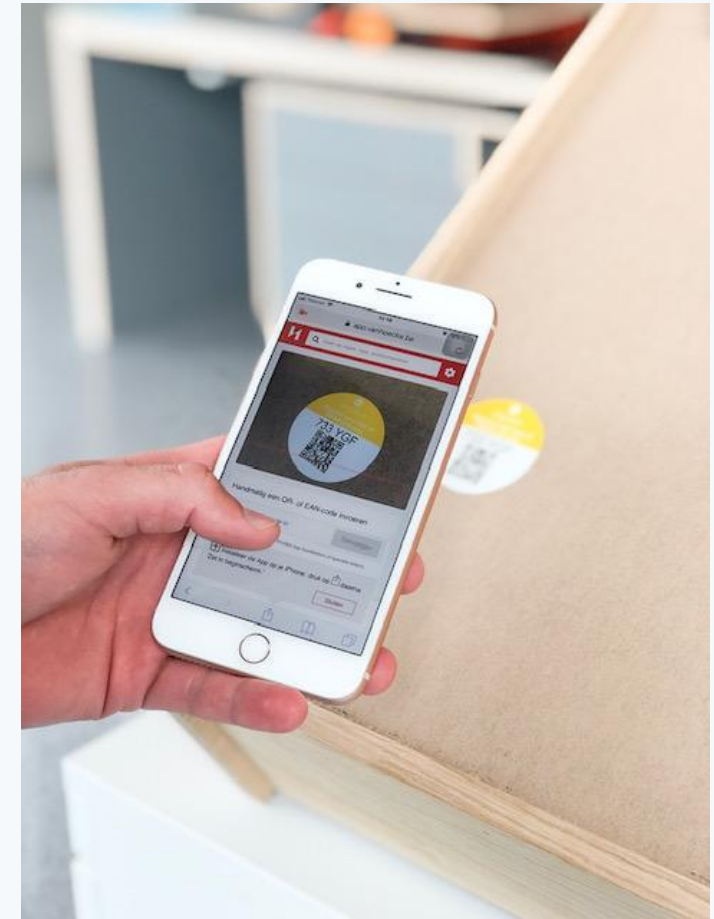
Source: vanhoecke.be



## 7. DIGITAL TRANSFORMATIONS STUDY CASE #6: BELGIUM

### What did the transformation bring to the company (what changed)?

- Van Hoecke's transformation story is a true success. Over the past 5 years, their turnover increased by 23%, their staff increased by no less than 75% (from 114 to 225 employees).
- In the meantime, 43,000,000,000,000 (yes, 43 thousand billion!) different combinations can roll off the production line with an average turnaround time of just three days. As a result, Van Hoecke is able to deliver to 4000 customers every day. This means 70 tons of furniture fittings and more than 9000 pallets.
- Moreover, due to the implementation of their 'online configurator', there are no longer any intermediate stocks.



Source: [vanhoecke.be](http://vanhoecke.be)

## 7. DIGITAL TRANSFORMATIONS STUDY CASE #6: BELGIUM

### What is the company known for now?

The motto towards customers for this TA'OR box is: "plug and play".

Although the box system is delivered in individual components, unpacking and assembling the box system takes not much time since precision is guaranteed and no extra tools are needed.

The website of TA'OR is very attractive as well, with lots of pictures how the box looks like, what the different designs are. Sayings as "the new era has arrived" and "out of the box thinking pays" informs the customer that this product is very innovative. There is even a movie to discover how every box is produced and prepared for transport in 48 hours (<http://www.taorbox.com/en/supply-chain>).



Source: vanhoecke.be



#### Customised work from 1 piece

Our pre-mounted drawers are made to your exact specifications and delivered within 72 hours. All possible combinations can be delivered from a single piece.



#### High quality

We guarantee superior quality for all of our products, so that they are ready for intensive use.



#### Stellar customer service

Through our services and bespoke accompaniment, we love to share our expertise with our customers.



#### Punctual delivery

Products from stock are delivered within 24 hours in the whole Benelux. All from our distribution center in Sint-Niklaas.

## 7. DIGITAL TRANSFORMATIONS STUDY CASE #6: BELGIUM

**How has the change impacted the management, the staff and the costumers? Conclusions.**

The transformation story of Van Hoecke NV from Sint-Niklaas shows that digitization and robotization of production processes create opportunities to make new products and reach new markets, resulting in increasing turnover and employment.

In 2022, Van Hoecke awarded the Factory of the Future for the third time. A great recognition for all the efforts we have made to become and remain a flexible, dynamic and future-oriented company.



Source: [vanhoecke.be](https://vanhoecke.be)

## 7. DIGITAL TRANSFORMATIONS STUDY CASE #6: BELGIUM

### What are the predictions for the future for the company?

In 2022, Van Hoecke has awarded the Factory of the Future for the third time. A great recognition for all the efforts they have made to become and remain a flexible, dynamic and future-oriented company.

The Factory of the Future award revolves around 7 main areas:

- Advanced manufacturing and technology
- Collaborate across departments on new developments
- Digitization of the enterprise and cyber security
- People-oriented organizing
- Networked organization with other companies
- Corporate Social Responsibility/ Ecological Footprint
- Smart production techniques

This recertification is an assurance that Van Hoecke remains future-oriented and that they have the flexibility to enrich the production process with evolving technologies, despite the additional challenges during the past COVID period.

They are constantly working to optimize the processes. Not only in function of the quality of the end product, but also in function of employees, the environment and the expectations of customers.



Source: [vanhoecke.be](https://vanhoecke.be)

## 7. DIGITAL TRANSFORMATIONS STUDY CASE #6: BELGIUM

Questions to revise the lesson learnt:

- What were the conditions that had to be met for the transformation to take place?
- How did the company prepare to undertake the transformation?
- Why did they have to face the barriers they faced?
- In what way did the transformation change the company?
- Analyse, if the company has become more resilient to future change? How yes, or why not?



Source: Pixabay

## 8. FOOD FOR THOUGHT

Examining all 6 study cases, can you identify what do the challenges the companies face have in common?

Based on the implemented changes in the presented cases, what do you believe was the key for transformation?

Can you determine 5 steps, that you would implement in company, to help them achieve bionic transformation?

Once the transformation starts, what do you believe must be monitored, to make sure it succeeds?

Try and find your own case of a digital company and look at their transformation process.

Does digital transformation apply to production companies only, or can you digitalize services as well?

Would you be able to create a transformation outside a company (apply bionic transformation in your personal life)?



Source: Pixabay



## 9. FURTHER INSIGHT INTO CASES

We suggest that you look at the websites of all 6 cases that are presented, to see what they are currently offering:

- <https://komunikacijeprihodnosti.si/>
- <https://www.leadingimplantcenters.com/>
- <https://www.nexum.com/en/services>
- <https://altab.pl/>
- <https://famasofas.com/inicio-en>
- [www.vanhoecke.be](http://www.vanhoecke.be)



# Fostering diGitalisation and blonic transformation of SMEs through the development of a novel and innovative Training material for overcoming COVID-19 crisis

[HTTPS://GIST-PROJECT.EU/](https://gist-project.eu/)



**Thank  
you**

# TU. 4

# LU. 15

**TRAINING UNIT 4 – BT CASE STUDY**

**LEARNING UNIT 15 – MAKING A BIONIC TRANSITION**

Your Text Here



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## DISCLAIMER

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Based on the previous learning unit, you will go through a hypothetical process of supporting bionic transformation of a company.

While going through the process, consider the prepared tool with the steps to follow while preparing the transformation.

This LU will prepare you to analyse the challenges of a company and equip you with knowledge to answer those challenges, enhancing your skill to become a facilitator of bionic transformation. You will be presented hypothetical situations in which you are the facilitator for bionic transformation and will have to guide the company in their process of transformation.

1. Steps of bionic transformation
2. Hypothetical company #1
3. Hypothetical company #2
4. Hypothetical company #3
5. Hypothetical company #4
6. What you have learned so far?



Source: Freepik

# 1. STEPS OF BIONIC TRANSFORMATION

There are seven steps for developing a digital strategy (taken from the case of Komunikacije prihodnosti) :

- 1) What do you want to achieve with digital strategy?
- 2) Selection of a professional partner for digitization.
- 3) Presentation of the company, vision and goals (especially in terms of changes due to digitalization).
- 4) Assessment of the current state of digitalization in the company itself.
- 5) Creating a company strategy for digital transformation with key areas (7 or 8 areas).
- 6) Company's digital capability development plan.
- 7) Preparation of the final Digital Strategy (5 years) and Action Plan (more details for 12-18 months).

In the following slides you will see how to prepare for steps 1 and 3 (other steps depend on more individual situations of each company).

## 2. HYPOTHETICAL COMPANY #1

- This family company exists for 30 years already. They are producing chairs and tables for domestic and office use.
- In the past 5 years they have been facing a decline of sale.
- They have 50 employees, who are skilled carpenters.
- The previous owner has handed the company to the next generation.
- The new CEO hired you to change their customer experience.



## 2. HYPOTHETICAL COMPANY #1

### STEP 1:

Before you can implement the 7 steps of bionic transformation, you need to get to know the company – try and identify the entire chain of the product.

- The chain includes various segments, including your suppliers (whom you get the materials from).
- Do not forget to include the customers/buyers of your products in order to get their full experience (how they found you, why they decided to select your product, and how satisfied they are with it).
- Also, focus on your distribution channels, from your own selling salon (if you have one), to outlets that sell your and other products.
- Naturally, keep in mind your own staff (in production, management, finances, and also legal department – dealing with any complaints).
- If possible, try to assess the future needs and trends in the sector by talking to potential customers.
- It never hurts to see what the competition is doing.



Source: Pixabay



## 2. HYPOTHETICAL COMPANY #1

### STEP 1:

PRACTICAL WORK: Fill out the table – identify at least 6 different individual segments of your product chain.

| Who      | Why is it important                         | What must I understand                                    |
|----------|---------------------------------------------|-----------------------------------------------------------|
| Retailer | They sell both my and competitive products. | What can I do, to convince the buyer to chose my product? |
|          |                                             |                                                           |
|          |                                             |                                                           |
|          |                                             |                                                           |
|          |                                             |                                                           |
|          |                                             |                                                           |
|          |                                             |                                                           |
|          |                                             |                                                           |



Source: Pixabay

## 2. HYPOTHETICAL COMPANY #1

### STEP 2:

- Conduct talks with representatives of each part of the chain.
- Collect feedback from every segment of your product chain, but keep in mind, that you need to put that feedback into a content.
- The most important part is to try and determine, what will help you sell your products in the future and how can you transform in order to be more efficient producing this product.
- However, if you are depending on other partners to sell your products, you need to consider their position, how they can best offer your product to the final customer.



Source: Pixabay

## 2. HYPOTHETICAL COMPANY #1

### STEP 2:

PRACTICAL WORK: Now imagine, what the feedback were (try to be realistic – below are made up examples for retailers). Make at least 3 responses for each group of people you were talking to.

- Retailer #1: The customers want to buy cheaper products.
- Retailer #2: The producers who give us bigger commissions get better placing and more support. Your product is not in the cheap class, but not really placed as high class product, so you are in between cheap and unpromoted and expensive but promoted products in our store.
- Retailer #3: We are using your products for our staff, so that's the best commercial you can get, as the buyers see it and we can give first hand experience about the quality of your office equipment.



Source: Pixabay

## 2. HYPOTHETICAL COMPANY #1

### STEP 3:

- Analyse the feedback collected.
- Use the collected feedback to prepare a SWOT analysis of your company and identify, what must be transformed and how this transformation can be achieved.
- Also, try to determine, if you can achieve the transformation with your own staff and knowledge, or if you will need an external expert.



Source: Pixabay

## 2. HYPOTHETICAL COMPANY #1

### STEP 3:

#### PRACTICAL WORK:

Use the collected feedback to prepare a SWOT analysis – add to the things identified through feedback of retailers.

#### Strength:

Our product is not considered cheap and without quality.

#### Weaknesses:

Our products are not recognised as high class and quality, but are not considered discount low cost products.

#### Opportunity:

We can start placing our products among high class and quality products.

#### Threats:

Among low price products, we cannot compete with cheap far east products.  
We are not established as high class.



Source: Pixabay

## 2. HYPOTHETICAL COMPANY #1

### STRATEGIC STEPS:

Use the data from the analysis to prepare the strategy, what needs to be done.

In the case of retailers, the strategy could be something like this:

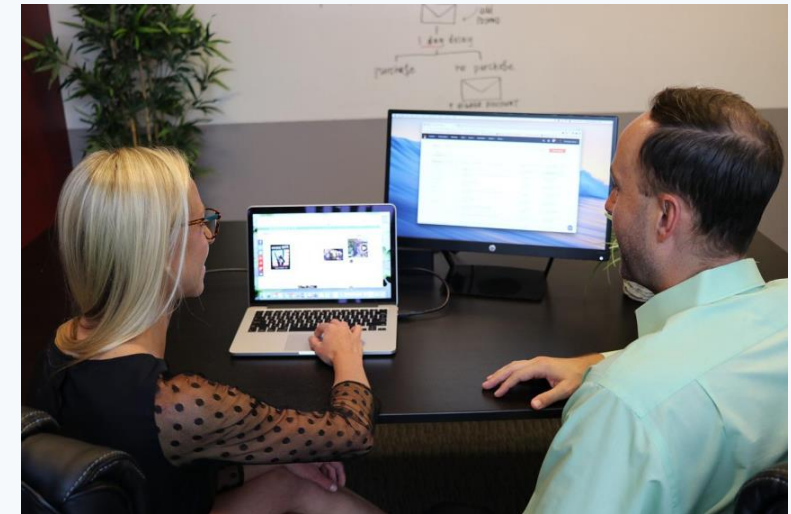
Our company will offer a better customer experience to increase our recognisability.

We will raise the added value of our product through customer interaction.

We will change the selling strategy through our retailers, to interact with end buyers.

We need to establish better ties with retailers, to achieve better product placement and endorsement from them.

NOW YOU KNOW WHAT YOU WANT TO ACHIEVE WITH THE DIGITAL STRATEGY (step 1 of the 7 steps - see slide 4).



Source: Pixabay



## 2. HYPOTHETICAL COMPANY #1

### TRANSFORMATION:

We need to create an interactive showroom when the end buyer will see our products and will have a virtual option of their modification.

We need to change our production line, not to create products on stalk, but on demand in customize them to best suit the buyer.

The price of the end product can be raised due to the added value, but must still be competitive with other high class products, but we must not try to be competitive with low class and price products.

We need to set up better online presence and marketing campaigns to gain recognisability and promote our strengths – high quality products.

NOW YOU KNOW WHAT YOUR VISION AND GOAL IS (step 3).



Source: Pixabay



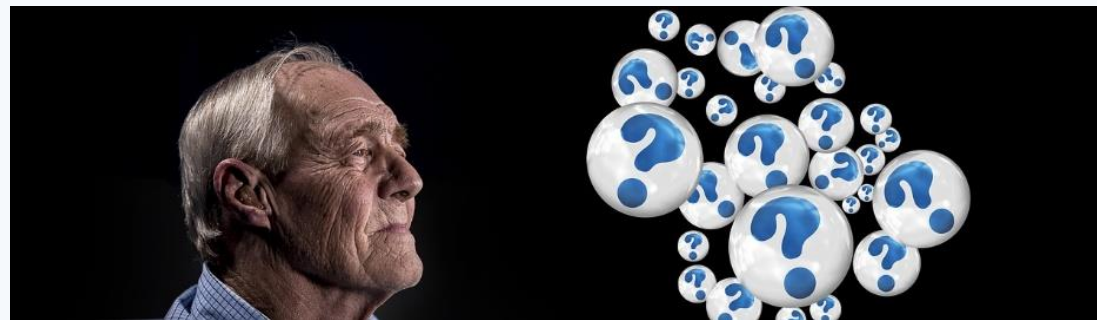
## 2. HYPOTHETICAL COMPANY #1

### WHAT ELSE?

Will you be able to foster the transition by yourself? Should you hire more staff to help with transformation and after it? Should you hire external experts? Can you get funding for the transformation? Can I get support in securing additional funding?

How much change will the transformation bring for your staff? How can you educate them to prepare for changes?

Prepare a realistic strategy of transformation with a realistic time frame. Create an action plan to start implementing the strategy (shorter than the transformation strategy time frame).



Source: Pixabay

## 2. HYPOTHETICAL COMPANY #1

### FOOD FOR THOUGHT

Try to imagine what the buyers who already have your products say – and how can you use that to make a new product – different from what you are already making, but connected to what you already have.

*Example: They like your products, they don't need to buy new ones because these last a long time, but they are getting dull, so they would want to refresh the existing product... to make it look new. So maybe you could make fitting seat cushions for existing chairs to „refresh“ them (even with custom patterns and colours).*

If this is the solution, prepare an app, where people can select your previous models of chairs (so the cushion will be the right size) and offer a selection of colours or patterns to choose from.

Now that you made that app, your staff is worried – how do you deal with that?

They are worried, how they will collect the orders and how they will implement them. The people physically making the cushions are worried, because they are not used to apps. The people handling shipping are worried, because they are not used to single shipping, because usually they did big logistics of many pieces of products to be in the warehouse of the retailer who was selling your products to the final buyer.

Can you train somebody from the staff only for new individual orders (the sale was declining, so it's better to re-train than lay off)?

Can you use some other form of delivery, besides your usual transports for big deliveries (postal service or other delivery providers, or maybe have your own logistics for small orders)?

Would the costs be feasible? How do you set a price for these individual services (keep in mind, that you are already offering customized whole products – that you are offering in the showroom – so this is just a part of your new vision).

### 3. HYPOTHETICAL COMPANY #2

This company exists for 80 years. They are producing bicycle frames for several bicycle brands.

As the company is not producing final products, you depend on the orders you get and they change at an ever faster rate.

You need to become more adaptive to the orders you get from your end producers.

They have different systems, and you need to be flexible to work with each of them.



Source: *VeloNews.com*

### 3. HYPOTHETICAL COMPANY #2

#### STEP 1

As you are part of the product value chain, you need to know what happens with your semi-products after you make them and send them to the companies that finalize the product.

Also, keep in mind, you need to be in touch with companies that produce your raw material (also depending on the materials from which the bicycle will be made).

Keep in mind, you are making mass production – not single prototypes, therefore your tools for making bicycle frames. It is not feasible to make individual frames, you should make them in large enough series before resetting the machines.

You are making frames for different types of bicycles: men's, women's, children – different sizes, mountain and road bicycles.



Source: [alibaba.com](https://www.alibaba.com)

### 3. HYPOTHETICAL COMPANY #2

#### STEP 1

PRACTICAL WORK: Imagine that you talked to your buyers (bicycle producers). What could be their demands?

Try to fill out the table below following the give example (other two companies: 1 is producing sporting bicycles; 2 is producing city bicycles and e-bicycles).



Source: Pixabay

| Company                | Their need                                                                                                                                                                                                                          | Their challenge                                                                                                                                                       |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1 child bicycle maker | They need 15.000 regular frames in three different sizes (total 45.000 frames) until December, to assamble for spring sales. Additionally they need 3.000 aluminium frames (in 2 sizes) by October, to assemble for Christmas sale. | They are cutting costs on warehouse facilities and want to recieve all necessary parts for assembly at the same time. They need full compatibility between the parts. |
|                        |                                                                                                                                                                                                                                     |                                                                                                                                                                       |
|                        |                                                                                                                                                                                                                                     |                                                                                                                                                                       |

### 3. HYPOTHETICAL COMPANY #2

#### STEP 2

After identifying the needs of your buyers (and understanding their challenges) you have to try and find a way to solve their problem. One option is, to establish communication with other suppliers of parts and try to provide a joint service to the bicycle makers, or just to optimize your production.

Your decision depends on the capacity and development option of your company (do you want to and/or are able to become more than just the frame maker).



Source: Pixabay

### 3. HYPOTHETICAL COMPANY #2

#### STEP 2

PRACTICAL WORK: As you are not interested in starting to produce your own bicycles and start controlling the entire value chain, you decide to optimize your production. However, you want to be fully compatible with other suppliers, so you did communicate with them. You created a joined platform, where producers are ordering material for their bicycles – and all providers of semi-products see by when which articles will be delivered and which compatible parts they need: example 5000 aluminium frames and at the same time 5000 appropriate bicycle seats of fitting size.

This was you have better orientation what do you need to produce at what time, to best fit your buyers.



Source: Pixabay



## 3. HYPOTHETICAL COMPANY #2

### STEP 3

Analyse the feedback collected.

The joint platform you created with other suppliers determines how much material and how fast your production has to be.

Optimize your working process in order to use this data for ordering your own raw materials and organizing the work load (determining how much staff you need at what time).



Source: Pixabay

### 3. HYPOTHETICAL COMPANY #2

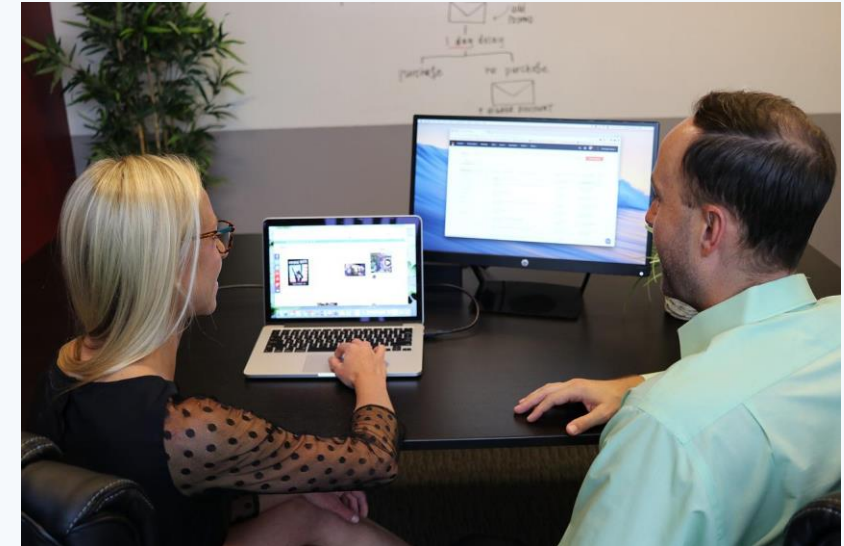
#### STRATEGIC STEPS

Use the data from the analysis to prepare the strategy, what needs to be done.

Which machines need to be upgraded, what software must you use?

Can you, based on the new optimized way also try and optimize your buys (getting raw material at lower prices, based on the fluctuation on the market)? Can you optimize your warehouse and storing capability and capacity?

When you answer these question, you will KNOW WHAT YOU WANT TO ACHIEVE WITH THE DIGITAL STRATEGY (step 1 of the 7 steps - see slide 4).



Source: Pixabay

### 3. HYPOTHETICAL COMPANY #2

#### TRANSFORMATION

You need to create a production line that is synchronized with other suppliers of bicycle producers over the jointly established platform that you will all use.

For optimal effect, you should get a consensus of all companies to hire a joint advisor who would help all of them to optimize and be compatible.

NOW YOU KNOW WHAT YOUR VISION AND GOAL IS (step 3).



Source: *VeloNews.com*

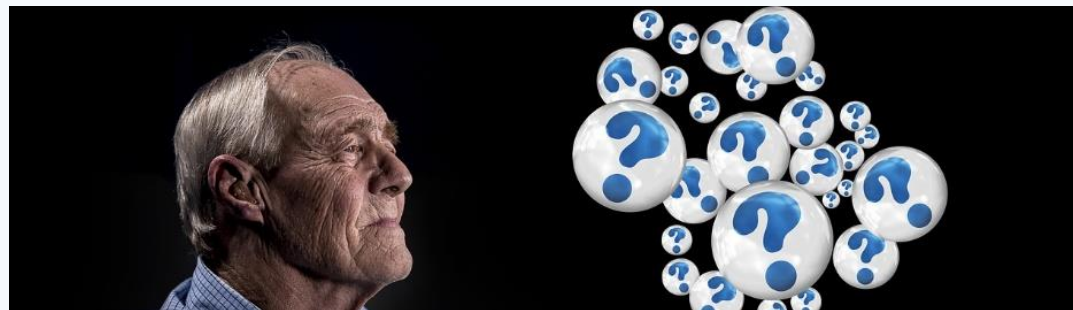
### 3. HYPOTHETICAL COMPANY #2

#### WHAT ELSE?

What will the new platform mean for your own production line? What will this mean for your staff?

Can you get funding for the transformation? Can I get support in securing additional funding? Is the fact that several companies are transforming at the same time a possible advantage to secure funding?

Prepare a realistic strategy of transformation within your company, with a realistic time frame that considers also the transformation of other companies that will use the same platform. Create an action plan to start implementing the strategy (shorter than the transformation strategy time frame).



*Source: Pixabay*

### 3. HYPOTHETICAL COMPANY #2

#### FOOD FOR THOUGHT

Will you need to change the machines of your production line (or only modifications of the existing one)?

Will you need to change your storage capacity (warehouse) for raw materials, or your semi-product before shipping it to your buyers?

In case of changing the storage capacity, can you use that into optimization as well?

Consider the platform – who will be in charge of it? Who will maintain it and ensure your compatibility with it?

Are there any further legal issues that can be sorted out (especially since the other companies follow different national legislation)? Can such issues also be optimized through digitalization?



Source: Pixabay

## 4. HYPOTHETICAL COMPANY #3

You are the owner of your company. You are a service provider.

Your main service is building management. You are providing the service for several buildings (some are commercial buildings and some are residential buildings).

You are looking for a way to be more efficient in your work.



Source: Pixabay

## 4. HYPOTHETICAL COMPANY #3

### STEP 1

Before you start your bionic transformation, you want to understand what are the needs of your clients and what are the capabilities of their end users (companies, residents) to use the digitalized tools.

For that purpose you need to talk to the building owners and also to typical representatives of the end users.

Also, remember, you are not the only company offering building maintenance, so you should take a look at what the competition is doing and try and see how that is working out.



*Source: Pixabay*



# 4. HYPOTHETICAL COMPANY #3

## STEP 1

PRACTICAL WORK: Talk to all segments of users of your services:

- Building owners (residential and commercial buildings)
- Tenants (both those who live there or have offices – or other business – there)

Identify their needs (from maintenance, to possible conflicts...).

Fill out the table following the example:



Source: Pixabay

| Who                           | Challenge                                                                                                                               | Suggestion for solution                                |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| Tenant in a rented flat       | Response time for maintenance – tenant has to contact owner to contact maintenance (your job).                                          | Direct contacts for maintenance services (through you) |
| Rented office in the building | Visitors/customers visiting offices complain about certain aspects in the building (not enough light in halls, smell in elevator, etc.) | No suggestions                                         |
|                               |                                                                                                                                         |                                                        |
|                               |                                                                                                                                         |                                                        |

## 4. HYPOTHETICAL COMPANY #3

### STEP 2

Based on all the feedback, analyse if the suggested solutions seem feasible.

Also, try to talk to owners and tenants of buildings you don't maintain – maybe they have solutions you can use... or maybe they have problems you could solve and they decide to change the maintenance provider.

Try to find more solutions that suit your business best, but also answer the challenges of most people.

Estimate the costs of possible solutions (and also how the solution is effecting your business – efficiency and similar).

Talk to buildings/flats/office owners about the solutions you would want to implement.



Source: Pixabay

## 4. HYPOTHETICAL COMPANY #3

### STEP 2

#### PRACTICAL WORK:

Now imagine, are the possible solutions you have agreed upon and will be installed. Based on the hypothetical examples the solution could be an electronic bulletin board.

This could provide direct feedback people living, working, or just visiting the building you enter are commenting upon. If directly linked to you, you will get instant feedback on what should/could be improved in the building, making your offer of maintenance much better than the competition.



Source: Pixabay

## 4. HYPOTHETICAL COMPANY #3

### STEP 3

Analyse the feedback collected.

Use the collected feedback to prepare a SWOT analysis of your company and identify, what must be transformed and how this transformation can be achieved.

Also, try to determine, if you can achieve the transformation with your own staff and knowledge, or if you will need an external expert.



Source: Pixabay

# 4. HYPOTHETICAL COMPANY #3

## STEP 3

### PRACTICAL WORK:

Use the collected feedback to prepare a SWOT analysis – add to the things identified through feedback of retailers.

#### Strength:

We are in touch with owners, but can still improve direct interaction with building users.

#### Weaknesses:

We must be informed of the feedback and react in the shortest time possible.

#### Opportunity:

We can get in touch with individual building users (tenants, visitors, etc.).

#### Threats:

There will not be a fast enough response Service.



Source: Pixabay

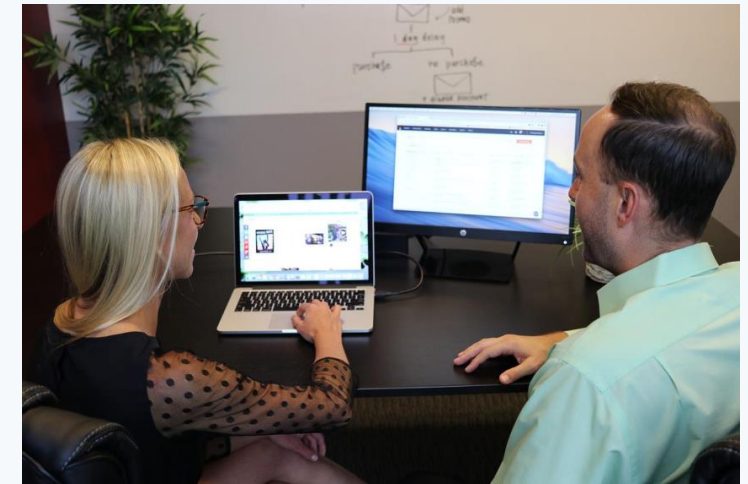
## 4. HYPOTHETICAL COMPANY #3

### STRATEGIC STEPS

My company needs to be prepared to respond very fast – especially in the part, where we cannot provide the service, but will need subcontractors.

We need to find a technical solution, that is easy enough to use for any body who is using the building we are maintaining, and also that provides clear feedback for my staff about the needs of the people from the building.

As this is your own company and the digitalization is on a smaller scale, you don't need to overthink it. You know you need to install electronic bulletin boards – especially in buildings, where this should not be a problem with people in the building (not suitable for residential building with many elderly residents); and you need to have access to the feedback from these bulletin boards, with a capacity for a fast fix of the problem reported.



Source: Pixabay

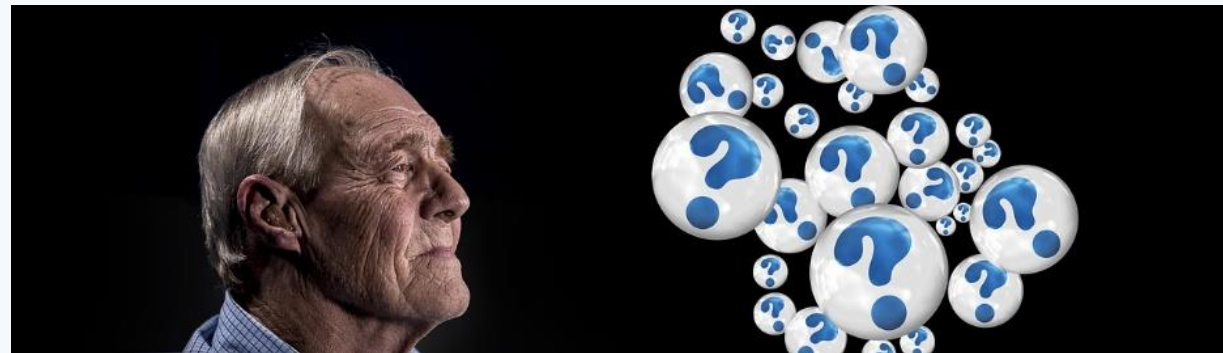


## 4. HYPOTHETICAL COMPANY #3

### WHAT ELSE?

Where to get the boards? In which buildings to start installing them? What information can the people provide there (lightbulb went out on floor 7; radiator on staircase leaking...) and how else could you interact (due to change of water valves there will be no water on Friday between 10 – 12 AM).

Prepare a realistic strategy of transformation with a realistic time frame. Create an action plan to start implementing the change.



Source: Pixabay



## 4. HYPOTHETICAL COMPANY #3

### FOOD FOR THOUGHT

What is the difference between a big system or a small system, when starting digitalization?

What is different, if you are a service provider, instead of a producer?

Why is overthinking a solution sometimes dangerous?



Source: Pixabay

## 5. HYPOTHETICAL COMPANY #4

You have taken over the family restaurant, with some rooms to rent.

Your restaurant has a 60 year tradition with international cuisine.

Renting rooms was always of secondary importance (usually if somebody booked your restaurant for a big event, like a wedding).

You have a website promoting your restaurant.

You don't deliver, nor are you connected with any food delivery service.

You are not part of any booking system for the rooms.

Your business is still turning up profit, but has been stagnating for 7 years, ever since the bypass road was completed and you are no longer near a main road connected.



Source:  
<https://www.malcajt.com/podravska/mari-bor/gostilna-pri-lipi-tasner.html>

## 5. HYPOTHETICAL COMPANY #4

### STEP 1

Before you can implement the bionic transformation, you need understand why you still have a large enough number of guests, to keep your company turning profit.

You need analyse the capacity of your staff and equipment, for preparation of additional meals.

With any change you are thinking of implementing, you need to either find the balance between what you will implement and its positive and negative impact on the current situation (the benefits of new things should outweigh the negative impact – for example, if more people order food from you via a food delivery system, will you have enough guests – as guests do spend more than people ordering from home; but you need to pay more staff).

Also, if you start attracting new target groups, will that effect your current target groups (having pet friendly rooms and attracting people who travel with pets, to stay over – will that drive regular guests away).



Source: Pixabay

# 5. HYPOTHETICAL COMPANY #4

## STEP 1

### PRACTICAL WORK

In order to get a clearer picture you should:

- Get feedback from guests that visit your business,
- Connect with food delivery providers,
- Connect with tourist promotion service,
- Check out, what competition is doing.



Source: Pixabay

Think what the feedback could be (see example below).

| Who               | Why is it important                                                                                                            | What must I understand                                                                                                                                       |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Tourist promotion | The tourist promotion of the city also promotes places to stay in connection with tourist products (such as traditional food). | What are the trends, if you want to attract the tourists to spend the night at your venue (additional offer – pet friendly, bike-rental, booking system...). |
|                   |                                                                                                                                |                                                                                                                                                              |
|                   |                                                                                                                                |                                                                                                                                                              |
|                   |                                                                                                                                |                                                                                                                                                              |

## 5. HYPOTHETICAL COMPANY #4

### STEP 2

Conduct talks with representatives of each of the identified groups.

Collect feedback from every identified group, but keep in mind, that you need to put that feedback into a content.

The most important part is to try and determine, what will help you to become more recognisable and help you attract more people to your restaurant / guest house.

However, if you are depending on other partners to sell your products, you need to consider their position, how they can best offer your product to the final customer (how the tourist promotion can best promote, how food delivery service can best promote you... in order to get their commission).



Source: Pixabay

## 5. HYPOTHETICAL COMPANY #4

### STEP 2

#### PRACTICAL WORK:

Now imagine, what the feedback were (try to be realistic – below are made up examples for tourist promotion). Think of more possible responses from other groups you were talking to.

- #1: You need to be easily available through public transport system (such as the bike-rental station at your guesthouse).
- #2: Guests look for more than just rooms to sleep in, you can offer traditional cuisine as part of the stay (dinner and breakfast).
- #3: Guests want to explore the location where they are staying. You should be able to provide them details about your surroundings., maybe even offer some history, as you have a 60 year of family tradition.



Source: Pixabay



## 5. HYPOTHETICAL COMPANY #4

### STEP 3

Analyse the feedback collected.

Use the collected feedback to prepare a SWOT analysis of your company and identify, what must be transformed and how this transformation can be achieved.

Also, try to determine, if you can achieve the transformation with your own staff and knowledge, or if you will need an external expert.



Source: Pixabay



# 5. HYPOTHETICAL COMPANY #4

## STEP 3

### PRACTICAL WORK:

Use the collected feedback to prepare a SWOT analysis – add to the things identified through feedback of retailers.

#### Strength:

Long family tradition with specific unique offer of food.

#### Opportunity:

Localized museum, offering traditional Food, offering pristine experience.

#### Weaknesses:

- No promotion
- Lack of skills for digitalization of products
- Not included into networks

#### Threats:

Potential loss of customers.



Source: Pixabay

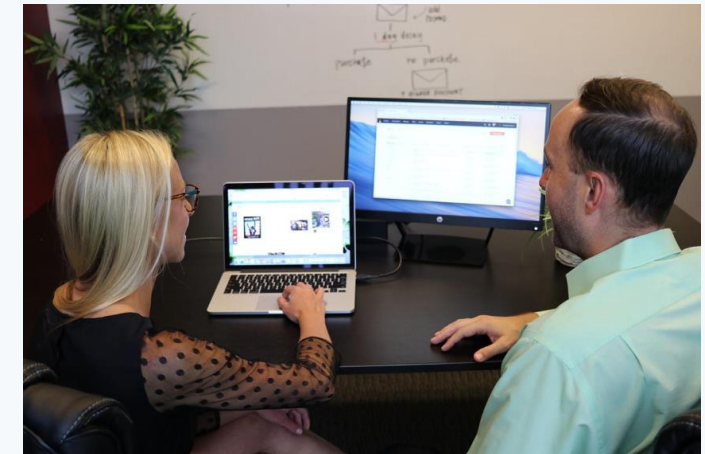
## 5. HYPOTHETICAL COMPANY #4

### STRATEGIC STEPS

Use the data from the analysis to prepare the strategy, what needs to be done.

Based on the examples given, the strategy could be something like this:

We need to be included into the tourist promotion. For that purpose we need to invest in the city bike-rental system, to have a station at our location. We also need to invest in a memorial family room, where we can present the history of our restaurant and the connection to local history, but most of all we need to have a booking system, where along with a room, or just dinner reservation, people can order in advance a high class meal to be prepared for them (traditional festive dinner – from the online menu, with option of adaptation and combination of offer).



Source: Pixabay

NOW YOU KNOW WHAT YOU WANT TO ACHIEVE WITH THE DIGITAL STRATEGY (step 1 of the 7 steps - see slide 4).

## 5. HYPOTHETICAL COMPANY #4

### TRANSFORMATION

We need to prepare online menu, from which our guests can book a meal in advance, together with the dinner table, and also with a room for overnight stay.

Our most popular meals should be available, with the options for guests to change certain things in advance, so they can already book the table and food in advance.

Our staff will take reservations through telephone and also through app. The reservation of a meal will be done with a credit card, so in case of a late cancelation the meals will still be paid for. Through advanced ordering, the service will be faster and the guests can circulate faster, thus allowing for a larger number of daily visitors.

The menu reservation will also be part of the promotion for the guesthouse, as guest can get the traditional meal and board package, with the visit to the family memorial room.

NOW YOU KNOW WHAT YOUR VISION AND GOAL IS (step 3).



*Source: Pixabay*

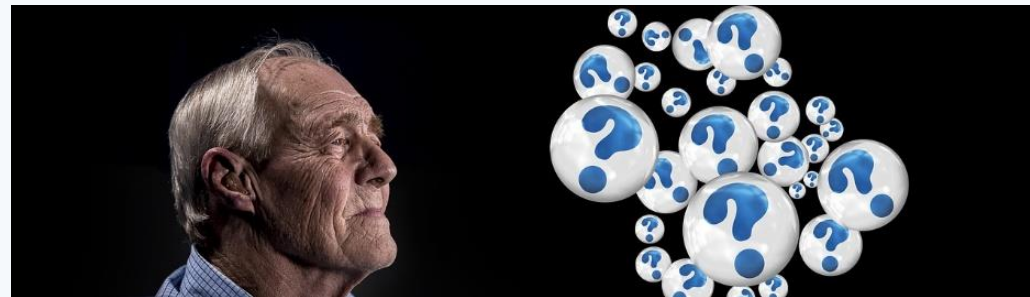
## 5. HYPOTHETICAL COMPANY #4

### WHAT ELSE?

Will you be able to foster the transition by yourself? Should you hire more staff to help with transformation and after it? Should you hire external experts? Can you get funding for the transformation? Can I get support in securing additional funding?

How much change will the transformation bring for your staff? How can you educate them to prepare for changes?

Prepare a realistic strategy of transformation with a realistic time frame. Create an action plan to start implementing the strategy (shorter than the transformation strategy time frame).



Source: Pixabay

## 5. HYPOTHETICAL COMPANY #4

### FOOD FOR THOUGHT

Why should you invest into other things than just digitalization?

Is there a benefit in offering new products along with the digital platform for the promotion of your business?

Is digitalization in this case just part of the promotion, or will your business be more efficient?

Compare the 4 cases – what type of businesses were presented?

Try and think of a similar type of business that you would implement bionic transformation in?

Do you believe that there are businesses which cannot benefit from digitalization?



Source: Pixabay

## 6. WHAT YOU'VE LEARNED SO FAR?

You have learned what should be considered in different type of business and how digitalization can be applied to small systems, large systems, systems that are more or less fully under your control, and systems where you are just a part of a larger chain, with little influence on the overall product.

These examples will help you apply other skills learned in other training units of the GIST course in practice, in order to achieve bionic (digital) transformation.



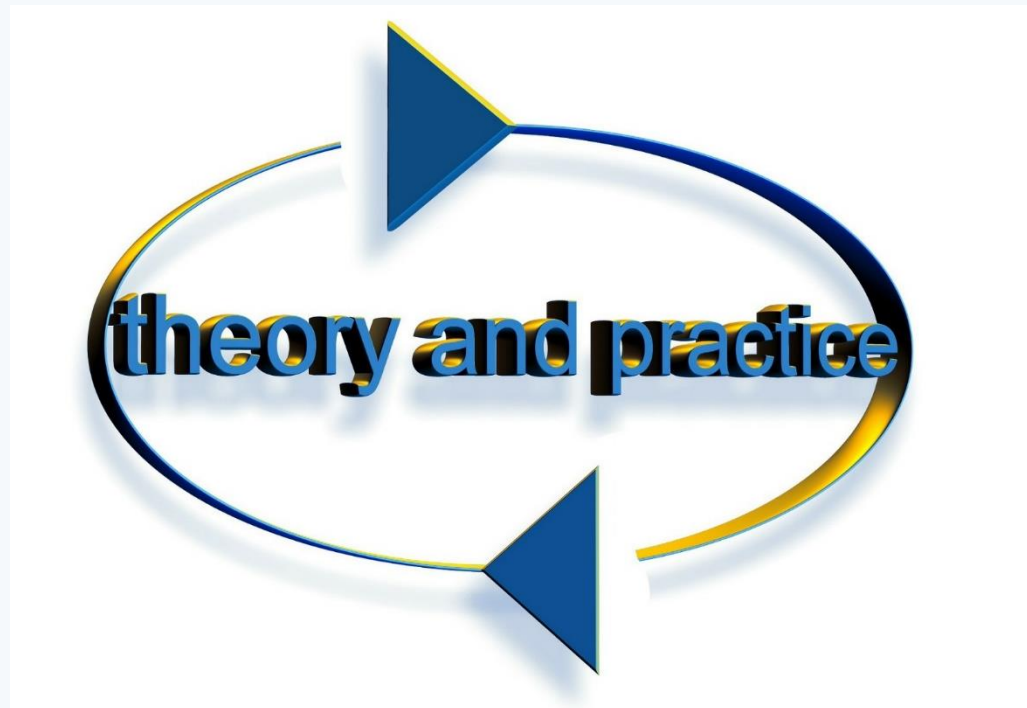
Source: Pixabay



The hypothetical cases of this learning unit were created by GIST project (and specifically by Slovenian partner, STP).

Any similarity with real companies are coincidental.

These cases are to be used as potential example of how to apply bionic transformation in real life cases, which share some similarities to hypothetical cases.



Source: Pixabay



# Fostering diGitalisation and blonic transformation of SMEs through the development of a novel and innovative Training material for overcoming COVID-19 crisis

[HTTPS://GIST-PROJECT.EU/](https://gist-project.eu/)



**Thank  
you**

# TU.5 LU. 16

**TRAINING UNIT 5 – COMPANY CULTURE**

**LEARNING UNIT 16 – INNOVATION UPTAKE**



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## DISCLAIMER

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## 1. Introduction to Innovation Management Systems

- 1.1. Types of innovation
- 1.2. Steps to manage innovation
- 1.3. Innovation management system in an organisation
- 1.4. Roles in the innovation management systems

## 2. Innovation Thinking

- 2.1. Stages of innovation thinking
- 2.2. Innovation Thinking practical example in furniture

## 3. Greg Satell's Innovation Matrix

- 3.1. Who is Greg Satell?
- 3.2. The 9 rules of innovation by Greg Satell
- 3.3. Introduction to Greg Satell's Innovation Matrix

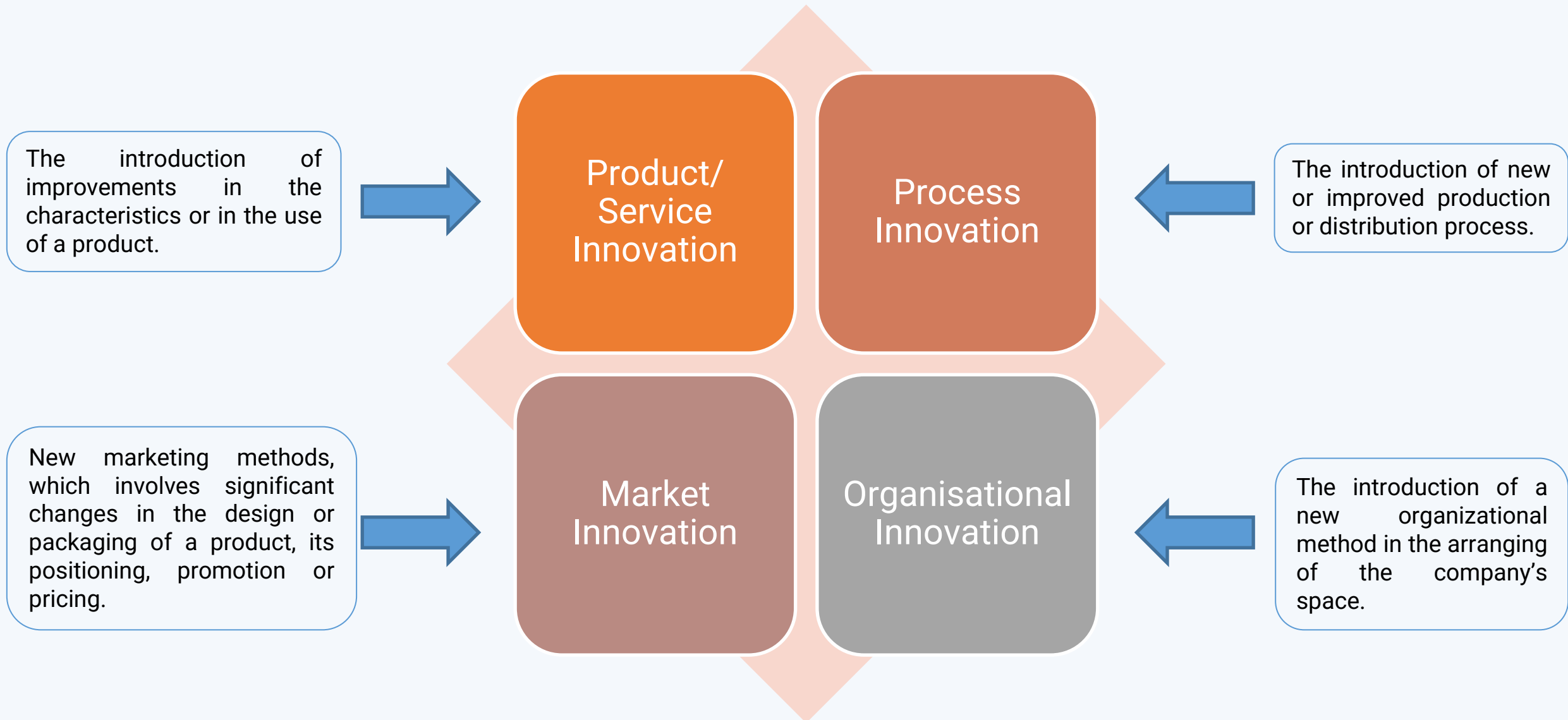
## 4. Conclusions



*Innovation. Source: Freepik*

# 1. INTRODUCTION TO INNOVATION MANAGEMENT SYSTEMS

## 1.1. TYPES OF INNOVATION



# 1. INTRODUCTION TO INNOVATION MANAGEMENT SYSTEMS

## 1.2. STEPS TO MANAGE INNOVATION

### 1. STRATEGIC DIMENSION

The first step for a company is to implement their strategic technological plan to define the process of what must be done to move from their current status to a new one (the desired).

### 2. DEVELOPING IDEAS

There are several techniques to identify and generate innovative ideas (e.g., techniques based on creativity or technological watch and competitive Intelligence).

### 3. PROJECT DEVELOPMENT

The introduction of innovative initiatives in the management of innovative and technological projects.

### 4. RESULTS EXPLOITATION

Three steps or stages should be implemented to exploit the obtained results: guarantee of innovation, exploitation of innovation and finally, knowledge management.



*Source: Freepik*

# 1. INTRODUCTION TO INNOVATION MANAGEMENT SYSTEMS

## 1.3. INNOVATION MANAGEMENT SYSTEM IN AN ORGANISATION

The implementation of an Innovation Management System have **multiple benefits** to an organisation:

- Higher growth, revenue and benefits from innovations.
- New ideas and new values.
- Obtaining value proactively by identifying future needs and possibilities.
- Risk identification.
- Taking advantage of the creativity and collective intelligence of the organisation.
- Collaboration between partners.
- Greater involvement among the members of the organisation.



Source: Freepik

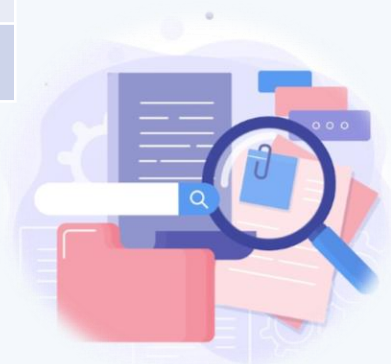


# 1. INTRODUCTION TO INNOVATION MANAGEMENT SYSTEMS

## 1.3. INNOVATION MANAGEMENT SYSTEM IN AN ORGANISATION

Before starting with the Innovation Management System, **an organisation must determine the internal and external issues** related to its objectives:

| EXTERNAL ANALYSIS SHOULD TAKE INTO ACCOUNT                                          | INTERNAL ANALYSIS SHOULD TAKE INTO ACCOUNT                                                         |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Market aspects (competition, partners, suppliers, user needs, etc.)                 | Existing management practices and the application of other regulations on management systems       |
| Technical aspects (intellectual property, normative, scientific developments, etc.) | Attitude and commitment to innovation                                                              |
| Political aspects (legislation)                                                     | Capacity (existing and necessary skills, facilities, equipment, investment capacity in innovation) |
| Economic aspects (macroeconomic situation)                                          | Operational aspects (business models, processes, products and services)                            |
| Social aspects (trends, demographics)                                               |                                                                                                    |



# 1. INTRODUCTION TO INNOVATION MANAGEMENT SYSTEMS

## 1.3. INNOVATION MANAGEMENT SYSTEM IN AN ORGANISATION

After the implementation of an Innovation Management System, the results obtained will have financial and non-financial benefits for the organisation.

| FINANCIAL BENEFITS                               | NON-FINANCIAL BENEFITS                                                 |
|--------------------------------------------------|------------------------------------------------------------------------|
| Increase in profits                              | Greater number of ideas                                                |
| Increase in income                               | Greater market share                                                   |
| Cost savings for the organisation and the client | Greater process efficiency                                             |
| Operating margin growth                          | Recognition of the organisation’s brand                                |
| Recovery of investment in innovation             | Impact on the number of employees                                      |
|                                                  | Intangible assets (patents, designs, Human Resources, knowledge, etc.) |
|                                                  | Ecological sustainability                                              |



Source: Freepik



Source: Freepik

# 1. INTRODUCTION TO INNOVATION MANAGEMENT SYSTEMS

## 1.4. ROLES IN THE INNOVATION MANAGEMENT SYSTEMS

One of the main roles in an Innovation Management System is the **INNOVATION MANAGER**, who will be responsible for the process. This role is not necessarily the person creating the ideas, but this role should establish the measures and form the structures and the culture so that the ideas are generated and transformed into new successful products and services. This worker also assigns the responsibilities and authorities to the relevant roles and communicated them to the whole organisation.

### General responsibilities for the management of innovation:

- Ensuring the effectiveness and efficiency of innovation.
- Performing operational planning.
- Starting and guiding the innovation process.
- Assigning the corresponding responsibilities to each innovation project.
- Coordinating different innovation projects.
- Informing the management staff of progress and operation.



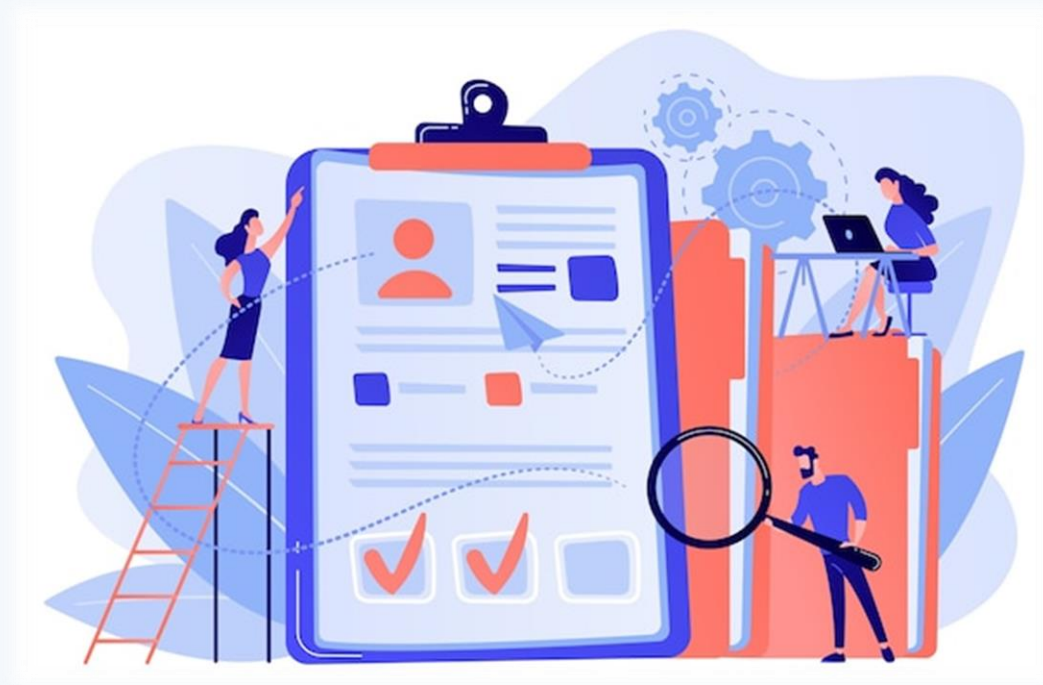
Source: Freepik

# 1. INTRODUCTION TO INNOVATION MANAGEMENT SYSTEMS

## 1.4. ROLES IN THE INNOVATION MANAGEMENT SYSTEMS

Apart from the figure of the innovation manager, **Human Resources policy** should incorporate a strategic approach to:

- Encourage creativity, learning and knowledge sharing.
- Implement job specifications that allow for variations, challenges and open interactions.
- Encourage open interactions, trust, diversity and tolerance.
- Provide procedures for the recruitment of staff with appropriate incentives for innovation.
- Promote participation in the innovation process.
- Allow members access to information.



## 2. INNOVATION THINKING

### 2.1. STAGES OF INNOVATION THINKING

Innovation Thinking stems from the discipline of design, “design thinking”, traditionally focused on product design. The key factors of innovative thinking are the context of the organisation, people, triggers and constraints and the interactions of all of them and their relative strengths creating the appropriate innovative thinking approach for the organisation.

There are six stages to implement innovative thinking that turn Design Thinking into an iterative process designed to increase the knowledge base and thereby, develop an appropriate business outcome.



## 2. INNOVATION THINKING

### 2.1. STAGES OF INNOVATION THINKING

#### 1. COLLECTION OF INFORMATION

Information is collected from all those who interact with the opportunity.

#### 2. GENERATION OF SOLUTIONS

New ideas are developed to generate solutions. The creativity process is involved in this generation of ideas through original thinking.

#### 3. QUICK LEARNING

During this stage, the organisation uses rapid visualizations, models, user tests and prototypes to know whether the idea is viable.



Source: Freepik



## 2. INNOVATION THINKING

### 2.1. STAGES OF INNOVATION THINKING

#### 4. VALIDATION

The potential solutions developed in the previous stage are validated by all those who interact and may be affected by them.

#### 5. SYNTHESIS OF RESULTS

This stage integrates creatively produced options with market opportunities and technical business feasibility to create knowledge-based solutions appropriate for the organisation.

#### 6. RESULTS

Management should decide as to which of the possible options from the previous stage provides the best solution to the problem or opportunity identified in the organisation.



Source: Freepik





### 2.2. INNOVATION THINKING PRACTICAL EXAMPLE IN FURNITURE SECTOR

**ECOFUR** is a furniture manufacturing company located in Belgium. After a market crisis that significantly affected the business, ECOFUR took part in a European funding program to explore new opportunities for growth development.

The first step of the company was to **analyse the four key factors of innovative thinking** which the following results:

- **Context:** the three owners of the company had invested a large part of their capital to sustain the business and with the market crisis the number of clients was dramatically reduced.
- **People:** All the people associated with the business (internal and external ones), were involved in supporting this activity.
- **Activators:** The company had established a strong online sales network, and the effort and interest of the owners and works to innovate in the business.
- **Restrictions:** lack of available funds.



## 2. INNOVATION THINKING



### 2.2. INNOVATION THINKING PRACTICAL EXAMPLE IN FURNITURE SECTOR

Secondly, the company started to implemented the different stages of innovation thinking:



*Source: Freepik*

#### 1. COLLECTION OF INFORMATION

Different activities were implemented to collect information on potential client companies. This information collected helped the company to identify their clients' needs. Finally, a second analysis was also conducted to find out the blooming aspects of the construction sector directly related to habitat sector.

#### 2. GENERATION OF SOLUTIONS

All the staff participated in a creativity session to explore what they could offer to meet the new clients' needs. In this session, a set of ideas was generated, evaluated and then aligned with the defined objectives. After that, new solutions were developed.

#### 3. QUICK LEARNING

Using digital tools such as social media, websites, email and video, the owners started to contact people and present the new solutions. At the same time, an analysis of competitive products were explored and reviewed. Finally, two concepts were selected for a trial implementation.

### 2.2. INNOVATION THINKING PRACTICAL EXAMPLE IN FURNITURE SECTOR

#### 4. VALIDATION

The two new concepts were tested in the market with selected major customers to validate the solutions and to identify the value of the service and the products that were being offered.

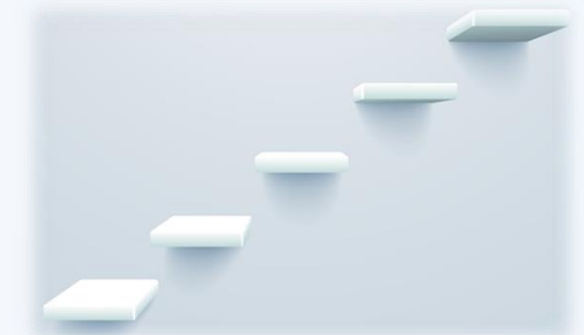
#### 5. SYNTHESIS OF RESULTS

The results of the previous stage allow the company to measure the solutions in terms of market opportunities, potential markets, business and technical viability, etc.

#### 6. RESULTS

After the nine months of innovation thinking implementation, the results obtained were:

- Three new manufacturing processes were developed
- The customer base increased by 50%
- Turnover increased by 80%
- Exports were responsible for 70% of the income generated
- Online sales increased by 30%



Source: Freepik

## 3. GREG SATELL'S INNOVATION MATRIX

### 3.1. WHO IS GREG SATELL?

Greg Satell is a popular author, speaker and innovation advisor, whose work has appeared in Harvard Business Review, Forbes, Fast Company, Inc. and other A-list publications. Over the last 20 years he has managed market leading business and overseen the development of dozens of pathbreaking products. Greg helps organisations to grow through “bringing ideas into practice”. He applies rigorous frameworks to identify the right strategies for the right problems, helps build an “innovation playbook” to tackle the challenges of the future and drive transformative change.



Greg Satell. Source:  
<https://gregsatell.com/>

## 3. GREG SATELL'S INNOVATION MATRIX

### 3.2. THE 9 RULES OF INNOVATION BY GREG SATELL

1. **Innovation is never a single event.** Innovation is a drawn out process involving the discovery of an insight, the engineering a solution, and then the transformation of an industry or field.
2. **Innovation is combination.** Great innovation almost never occurs within one field of expertise, but it is almost invariably the product of synthesis across domains.
3. **First, ask the right questions.** The best way to start is by asking the right questions: How well is the problem defined? How well is the domain defined? Once you have asked those questions, you can start defining a sensible way to approach the problem using the innovation matrix.
4. **There is no "right" size for innovation.** While it is true that small, agile companies can move fast, larger enterprises have the luxury of going slow. They have loyal customers and an abundance of resources. They can see past the next hot trend and invest for the long term.
5. **Leverage open innovation to expand your capabilities.** Many companies are now embracing open innovation to expand capabilities, most of them will find that solving their most important problems will require skills and expertise they do not have. That means that, at some point, you will need to use partners and platform to go beyond your own internal capabilities.

### 3. GREG SATELL'S INNOVATION MATRIX

#### 3.2. THE 9 RULES OF INNOVATION BY GREG SATELL

**6. Disruptive innovations require new business models.** The tricky thing about disruptive innovations is that they rarely fit into existing business models and, therefore, the value they create is not immediately clear. It is not just products that we have to innovate, but business models as well.

**7. Innovate the core (the 70/20/10 rule).** Many people think of innovation as discarding the old to make room for the new, but as Bain & Co.'s Chris Zook of points out in Profit From The Core, smart companies realise that the bulk of their profits will come from current lines of business. The premise of the rule is simple: focus 70% of resources in improving existing technologies; 20% toward adjacent markets and, finally, 10% on completely new markets.

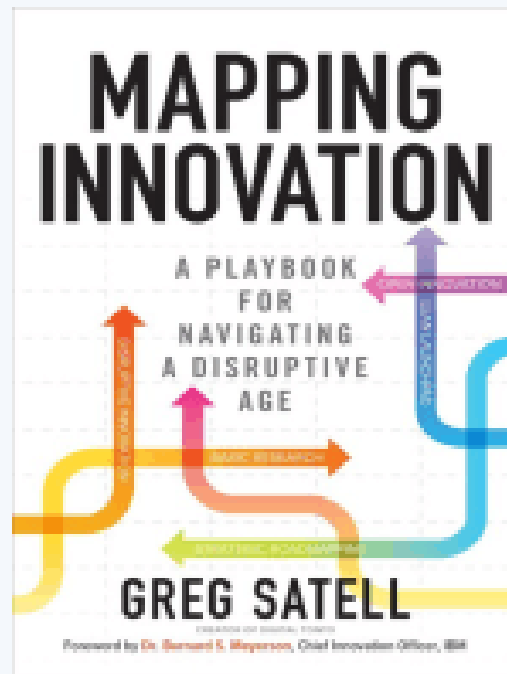
**8. In the digital age, we need to use platforms to access ecosystems.** In the 60's, it was difficult (if not impossible) to actively collaborate across time and space. Today, however, we can use platforms to access ecosystems of technology, talent and information. In a networked world, the surest path to success is not acquiring and controlling assets, but widening and deepening connections.

**9. Collaboration is the new competitive advantage.** The problems we are trying to solve are significantly more complex than in previous generations, although access to information has been democratized, which is faster than ever and easily at hand (46% of the world's population use their smartphone daily). Collaboration is becoming a competitive advantage, as increasingly, to solve complex problems, we need great efforts to integrate people with diverse talents into a single team to solve these problems.

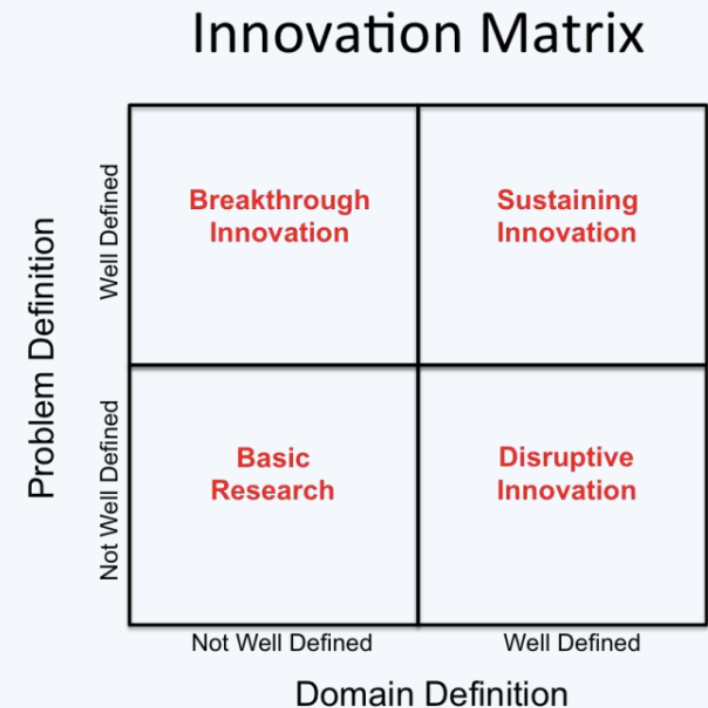
## 3. GREG SATELL'S INNOVATION MATRIX

### 3.3. INTRODUCTION TO GREG SATELL'S INNOVATION MATRIX

He published the book "Mapping Innovation" whose main insight is that innovation is really about solving problems. Under this context, he launched an innovation matrix.



Greg Satell's Book (Mapping Innovation). Source: <https://es.scribd.com/author/370156680/Greg-Satell>



Greg Satell's Innovation Matrix. Source: <http://www.game-changer.net/2017/05/22/mapping-innovation-with-greg-satell/>



# 3. GREG SATELL'S INNOVATION MATRIX

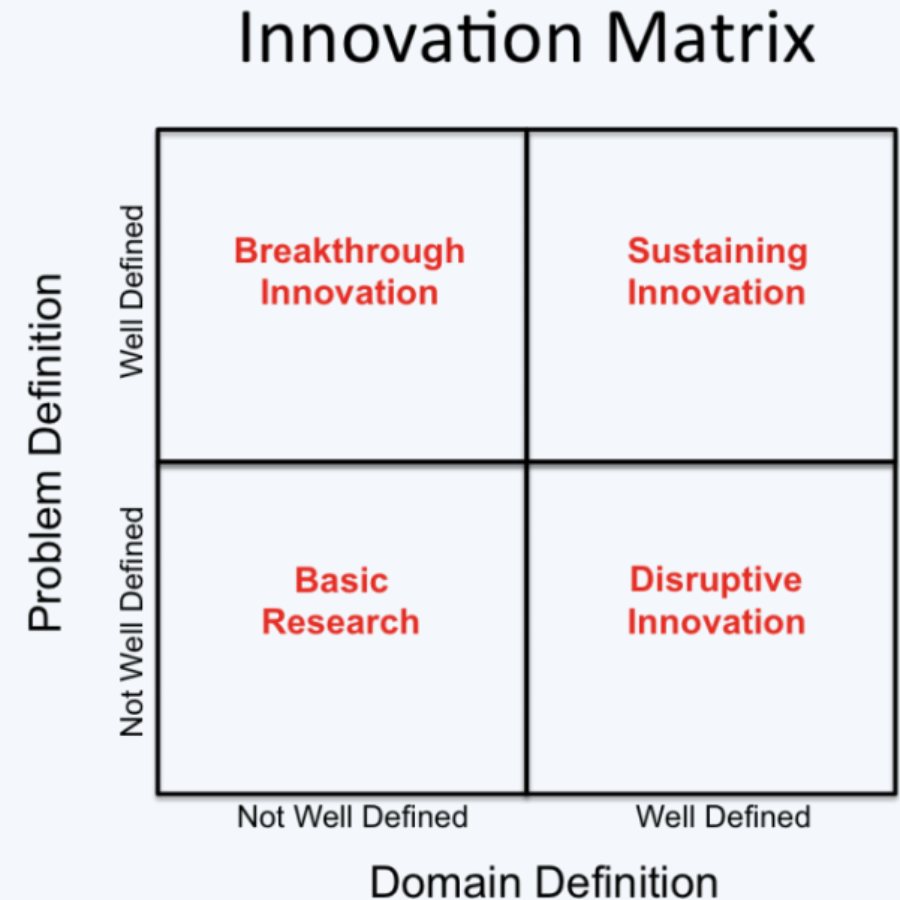
## 3.3. INTRODUCTION TO GREG SATELL'S INNOVATION MATRIX

The different quadrants in the matrix are not supposed to be a different part of the process of solving a problem, but it is always supposed to be forward-looking. So, the purpose of the innovation matrix is not to classify innovation in the current time.

The way the matrix is set up is just to ask two basic question about a company/organisation problem:

1. How well is the problem defined? For example, could you define a technical specification for this problem? If you can determine a technical specification, that is a well-defined problem.
2. How well is the domain defined? Meaning what set of skills do you need to solve this problem? If you can define those domains very well, you can think exactly the job descriptions you would use to help staff up a project like that.

So, the power of the innovation matrix is by narrowing down what set of solutions or what set of strategies are best fit to solve a particular problem.



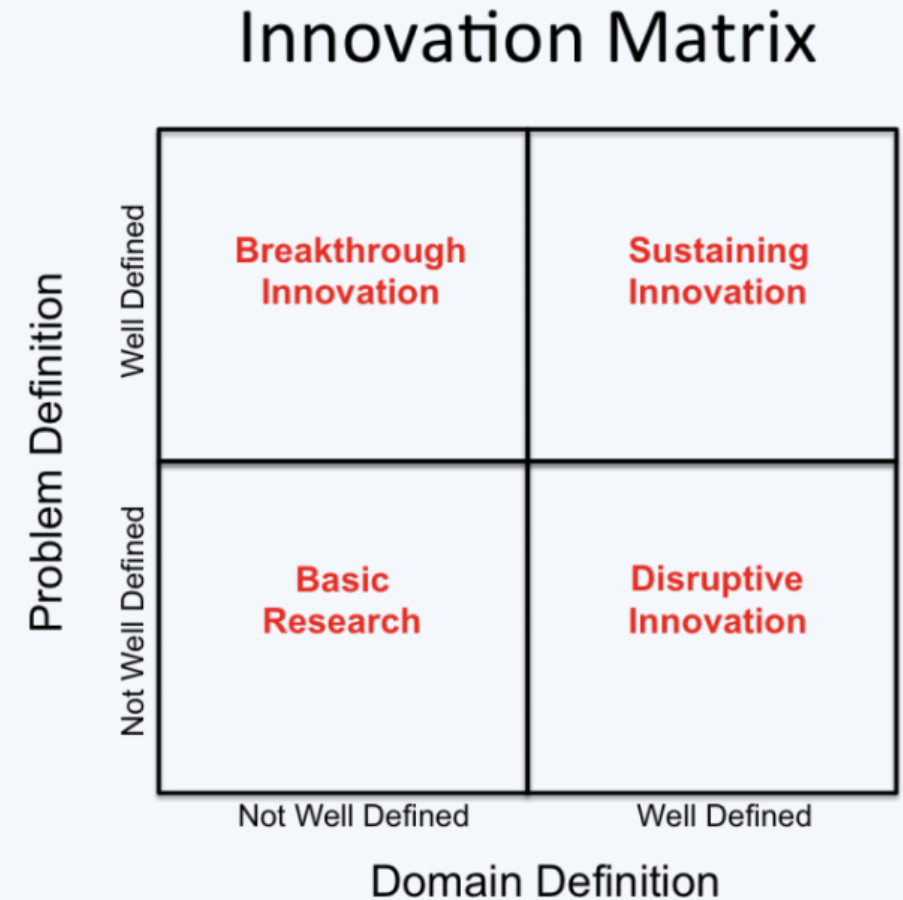
*Greg Satell's Innovation Matrix. Source: <http://www.game-changer.net/2017/05/22/mapping-innovation-with-greg-satell/>*

### 3. GREG SATELL'S INNOVATION MATRIX

#### 3.3. INTRODUCTION TO GREG SATELL'S INNOVATION MATRIX

Hence, using this methodology proposed helps determine the reality of any assessment, avoiding finding black boxes that are not explained. To apply this assessment methodology, the following steps must be taken:

1. To determine the company's innovation map, present and future. To identify the company's foreseeable evolution in terms of innovation.
2. To carry out the assessment taking into account the previous step. To estimate the economic value of the company without disruptive innovations and the economic value of possible disruptive innovations.
3. To apply this approach to all relevant projects or business units.



*Greg Satell's Innovation Matrix. Source: <http://www.game-changer.net/2017/05/22/mapping-innovation-with-greg-satell/>*

## 4. CONCLUSIONS

Innovation has become like a religion in business today, with “innovative or die” as its mantra. When an organization succeeds, people attribute its good fortune to superior innovation. When it fails, people say it lacked the ability to innovate, no matter how many new products or initiatives it launched. The message is simple: you need to disrupt to survive.

Our history and our past teach us that “innovation” is never a single moment, a single act, a single idea, a single mind or even a single inventor. To truly create an impact, we need to tap into entire ecosystems of discovery, engineering, and transformation. Innovation is combination.

Under this context, companies must implement an effective innovation management model for the increasing innovation activity not to become a problem. For all these reasons, the first part of this LU gives an overview of Innovation Management Systems which are recognised by the CENT/ TS 16555 standard, as an essential tool to foster innovation. Apart from that, the concept of Innovation Thinking has been integrated also into chapter two as a creative thought process used to generate ideas and solutions. In addition, a real success case implementing this method will be detailed.

Finally, the theory and matrix of Greg Satell have been detailed to give another example of a tool to be implemented in furniture companies to analyse their context and find new, innovative and disruptive solutions for their businesses.

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# Fostering diGitalisation and blonic transformation of SMEs through the development of a novel and innovative Training material for overcoming COVID-19 crisis

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# TU. 5

# LU. 17

**TRAINING UNIT 5 – COMPANY CULTURE**

**LEARNING UNIT 17 – LEADERSHIP**

Your Text Here



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This project has been funded with support from the European Commission (Ref: 2020-1-DE02-KA226-008154).

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## **1. Introduction**

- 1.1. Leadership definitions
- 1.2. Difference between leadership and management
- 1.3. Key leadership competences
- 1.4. Digital leadership competences
- 1.5. Leadership and ethics

## **2. Leadership stiles**

- 2.1. Leadership by Example
- 2.2. Empathetic Leadership
- 2.3. Authoritarian Leadership
- 2.4. Cooperative Leadership
- 2.5. Other leadership stiles

## **3. Effective leadership**

- 3.1. Conflict resolution
- 3.2. Dealing with change
- 3.3. Problem-solving
- 3.4. Leading innovation
- 3.5. Virtual leadership
- 3.6. Project planning and delegation
- 3.7. Building trust and respect
- 3.8. Coaching
- 3.9. Motivation
- 3.10. Effective Communication skills
- 3.11. Time management

# 1. INTRODUCTION

## 1.1. LEADERSHIP DEFINITIONS

- Leadership is a process by which an executive can direct, guide and influence the behaviour and work of others towards the accomplishment of specific goals in a given situation.
- Leadership is the ability of a manager to induce the subordinates to work with confidence and zeal.
- Leadership is the potential to influence the behaviour of others.
- Leadership is the capacity to influence a group towards the realization of a goal.

Leaders exist to serve others.

- Leader is a person who leads and guides others.
- Boss is someone who is the owner of the business.



Source: <https://www.freepik.com>

# 1. INTRODUCTION

## 1.2. DIFFERENCE BETWEEN LEADERSHIP AND MANAGEMENT

### Manage tasks and lead people

- Management – controlling a group or a set of entities to accomplish a goal.
- Leadership - an individual's ability to influence, motivate, and enable others to contribute toward organizational success.
- The influence and inspiration separate leaders from managers.

#### Management

- Task oriented
- Transactional
- Doing things right
- Events and tasks
- Rational thinking
- Instructs people
- Cognitive intelligence
- Relies on authority
- Push-approach
- Status quo

#### Leadership

- People-oriented
- Transformational
- Doing the right things
- Attitudes and behaviors
- Inspirational and visionary
- Listens and empowers
- Emotional intelligence
- Leads through others
- Asks people
- Pull-approach
- Risk taking

## 1.3. KEY LEADERSHIP COMPETENCES

**Leadership competences** - a specific combination of knowledge, skills, and abilities – **KSA model**

### **Competencies for leading the organization**

- Social intelligence
- Conflict management
- Decision-making
- Sharing a compelling vision
- Change management

### **Competencies for leading others**

- Interpersonal skills
- Emotional intelligence
- Being a good & trustworthy coach
- Inclusiveness
- People management

### **Competencies for leading oneself**

- (Learning) Agility
- Industry expertise
- Managing yourself
- Courage
- Organizational citizenship behavior

## 1.4. DIGITAL LEADERSHIP COMPETENCES

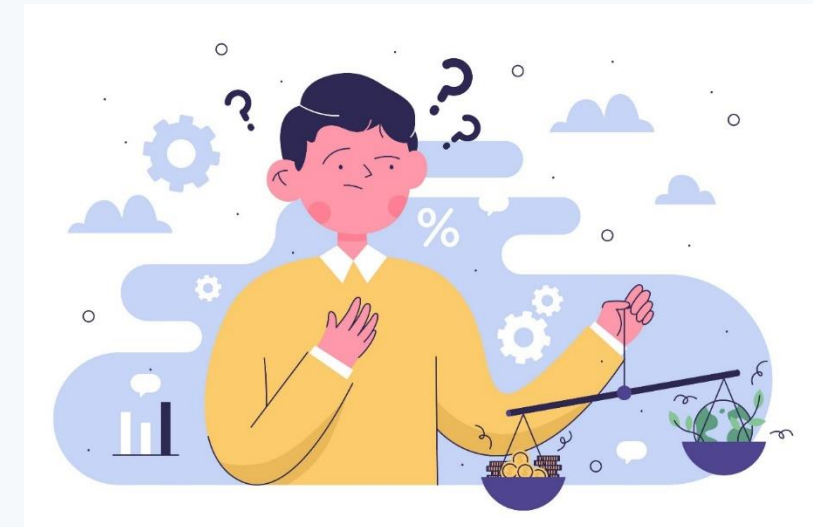
- **Inspire others** – creating a shared vision, atmosphere of transparency
- **Leverage technology** - leaders who embrace the use of digital tools and innovations realize results that accelerate their progress towards critical business goals.
- **Encourage collaboration** - leadership today and in the future must have the ability to keep people connected and engaged.
- **Drive innovation** - leaders can start by instigating new processes via tools that reduce manual and repetitive tasks, in that way freeing up their team for higher-value tasks and ideas.
- **Manage risk** - innovation requires both - thinking and the courage to take risks.



Source: <https://www.freepik.com>

## 1.5. LEADERSHIP AND ETHICS

- **Ethics and leadership go hand-in-hand.** Those who tend to think there is a choice to make between being profitable or behaving ethically are wrong.
- Leaders can inspire those around them to **behave ethically**.
- Being an **ethical leader** is essential for company/institution's credibility and reputation.
- Ethical leaders are necessary **drivers of success**.
- **Ethical leadership** - six main elements:
  - o Honesty,
  - o Justice,
  - o Respect,
  - o Integrity,
  - o Responsibility And
  - o Transparency.



Source: <https://www.freepik.com>

## 2. LEADERSHIP STYLES

- **Democratic Leadership** – Decisions based on input
- **Autocratic Leadership** – Decisions from a single source
- **Laissez-Faire Leadership** – Decisions come from employees
- **Strategic Leadership** – Decisions based on strategy and goals
- **Transformational Leadership** – Pushing to think and work in new ways
- **Transactional Leadership** – Employees get rewarded for work
- **Coaching Leadership** – Leader supports and guides employees
- **Bureaucratic Leadership** – Decisions come from company policy
- **Visionary Leadership** – Energetic focus on the future
- **Pacesetting Leadership** – Leaders sets ambitious goals
- **Situational Leadership** – Decisions and leadership styles vary by situation



### 2.1. LEADERSHIP BY EXAMPLE

- Model the behaviour where leader leads by his own example.
- Leader actively demonstrates the work by carrying some of the activities.
- This leadership style fosters high levels of engagement.



Source: <https://www.freepik.com>

### 2.2. EMPATHETIC LEADERSHIP

- **Empathetic leadership** - having the ability to understand the needs of others being aware of their feelings and thoughts.
- Today's successful leaders are more "**person-focused**" and able to work well with people from varying teams, departments, countries, cultures and backgrounds.
- Empathy in the workplace is **positively related to job performance**.
- Managers who practice empathetic leadership are **usually better performers** and have better results.

### 2.3. AUTHORITARIAN LEADERSHIP

- A management style in which an individual has **total decision-making power** and absolute control over his subordinates.
- Leaders make decisions with **little or no participation or creative input** from their colleagues or team members.
- Leaders independently preside over policies and processes.
- Group members are always **directly supervised** by the leader.
- Beneficial in industries and **organizations where decisions need to be made urgently and efficiently**, and where it is critical that certain tasks are performed in a specific way and there is very little room for mistakes
- Used in construction, manufacturing and the military.
- Using this leadership style prevents the chances of companies or projects getting side-lined by a lack of organization or solid deadlines.

### 2.4. COOPERATIVE LEADERSHIP

- An executive solicits input from the team before choosing the process for specific projects.
- Helps foster a cooperative and harmonic work environment.
- Leader tends to have a firm grasp on team building practices, connection-building activities and relationship – building exercises to improve cooperation.
- Leaders usually form strong teams.



Source: <https://www.freepik.com>

### 3. EFFECTIVE LEADERSHIP

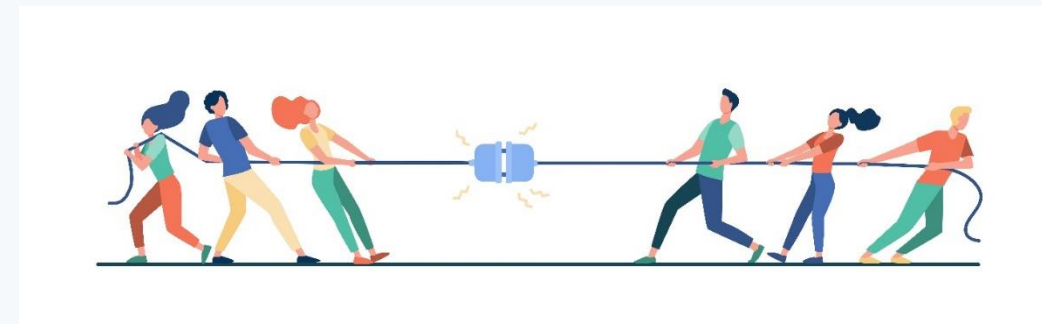
- Implement the company's vision, define a common dynamic and create unique company culture
- 10 Leadership skills for effective leaders:
  - Communicate and Connect Effectively
  - Inspire Confidence
  - Demonstrate High Emotional Intelligence
  - Build Trust
  - Promote Healthy Failures
  - Expand Common Ground
  - Make Difficult Conversations Easy
  - Manage Attention
  - Empower Employees
  - Deliver Constructive Feedback



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### 3.1. CONFLICT MANAGEMENT

- Conflict – disagreement between two or multiple persons who are unable to find a common solution
- Conflict management - the process to identify and handle disputes, where negative results are minimized and positive results are prioritised
- Leaders main tasks related to conflict management:
  - Deal with conflict management on a daily basis.
  - Ensure they continuously communicate with their team as well as articulate a vision.
  - Act responsibly, diagnose the conflict, be a good listener, maintain boundaries, respect differences, identify a goal.
- The ability to mediate in conflict situation within a company is a very important competence of a leader, therefore a leader would ideally also be competent in mediation.



### 3.2. DEALING WITH CHANGE

- Successful change is one of the biggest problems that modern organizations face.
- Without doing things differently a company is unlikely to succeed or last.
- **3C's of successful change leadership:**
  - COMMUNICATE – focus on the “why”, not just the “what” of the change.
  - COLLABORATE – break down organizational silos, encourage boundary spanning, don't tolerate competition.
  - COMMIT – model persistence, adapt to challenges, and stay positive and patient.



### 3.3. PROBLEM-SOLVING

**Problem solving skills** - the ability to identify problems, brainstorm and analyze answers, as well as implement the best solutions.

Main steps for successful leaders to solve the problem:

- Identify the problem / use digital technologies and data - think digitally
- Evaluate the problem / put yourself in the middle of the problem
- Communicate / collaborate / adapt to new environment
- Develop solutions through discussions
- Continuous improvement



Source: <https://pixabay.com>

### 3.4. LEADING INNOVATION

- Innovation is the process of development of original goods, services, processes or concepts.
- Companies that innovate are able to identify new opportunities and the best methods to solve current problems.
- Innovation is one of most important drivers for company's growth and success.
- Leading innovation asks for specific leadership approaches in upstream and downstream R&D activities.
- The more innovative the concept, the higher the risk.
- Main skills to lead innovative teams and companies:
  - Adaptability
  - Comfort and ambiguity
  - Curiosity
  - Creativity
  - Readiness to failure

### 3.5. VIRTUAL LEADERSHIP

- A form of leadership in which teams are managed via a remote working environment
- Successful virtual leaders need to cross time, space and culture barriers
- Difficult adjustment from traditional leadership modalities to the skills necessary for virtual leadership
- **New skills:**
  - Clear and concise communication.
  - Prioritization.
  - Strong support (virtual office hours, one-on-one meetings, feedback).



Source: <https://www.freepik.com>

## 3. EFFECTIVE LEADERSHIP

### 3.6. PLANNING AND DELEGATION

#### No control / total control dilemma

One of the most important questions for leaders:

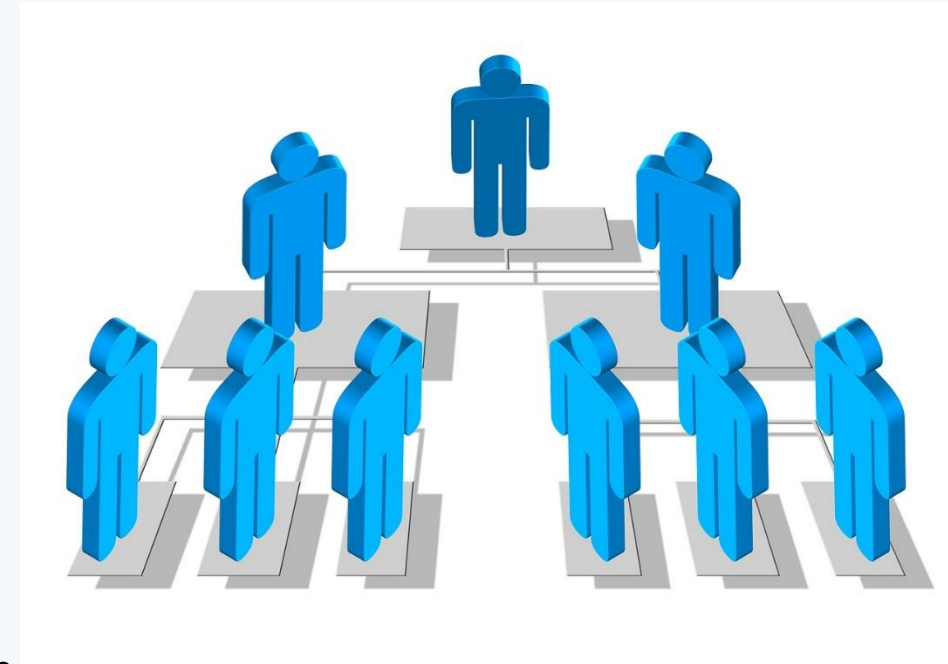
**How much planning is needed?**

- Complex tasks ask for complex planning!
- Simple tasks - no need for detailed planning!

**How much control is needed?**

Delegation (division of labor) and empowerment (allowing employees to act).

- Giving the responsibility and authority to subordinates to complete a task, and let the subordinates figure out how the task can be accomplished
- Allows leaders to hand over tasks to others whose skills are better aligned to accomplish that specific task.



Source: <https://pixabay.com>

## **3. EFFECTIVE LEADERSHIP**

### **3.7. BUILDING TRUST AND RESPECT**

**Trust and respect are essential preconditions to generate productive team members**

#### **Trust**

- Every Team Member Should Take Responsibility For Their Actions
- Trust What You Say And How You Behave
- Trust How You Will Treat Them And Others
- Believe You Are Honest

#### **Respect**

- How Your Behavior Will Be Interpreted And What Impact It Will Have
- New Behavior Strategy To Make A Change,
- Value Yourself For Who You Are,
- Feel Confident In What To Expect In Terms Of Your Attitude And Beliefs.

**Trust and respect create a safe working environment**

## 3. EFFECTIVE LEADERSHIP

### 3.8. COACHING

**Coaching** - temporary professional relationship where employees are supported to develop their personal capabilities, interpersonal skills, capacity to understand and empathies.

**Core coaching skills:**

- Attending To The Other Person Involved In A Coaching Conversation, Building Rapport With Them And Seeking To Understand What Is Going On For Them.
- Listening Carefully To The Other Person And Paying Attention To What They Are Saying And How They Are Saying It.
- Summarizing Or Paraphrasing What The Other Person Has Said As A Way Of Helping Them Reflect On Their Own Situation, Rather Than Giving Advice Or Adding In Your Own Judgement.
- Using Open Questions Which Encourage The Other Person To Say More, To Reflect And Understand More About Their Own Situation.
- Being Prepared To Give Honest, Clear And Specific Feedback While Making Sure The Relationship Stays Positive And Open.



Source:

<https://stepintoleadership.info/assets/pdf/SSSC%20Coaching%20section%20one.pdf>;

<https://www.freepik.com>

### 3.9. MOTIVATION

- **Motivation** is a goal-oriented characteristic to push employee to work hard at achieving goals.
- Leader **must understand the basic needs of employees** to be able to motivate them.
- Key **steps to motivate employees**:
  - Understand the position, needs and wishes of employees (be in their shoes)
  - Match the subordinate needs in line with the organisational goals
  - Reward and appreciate others as key motivation steps
  - Lead by example
  - Encouraging people and develop team spirit
  - Strong self motivation



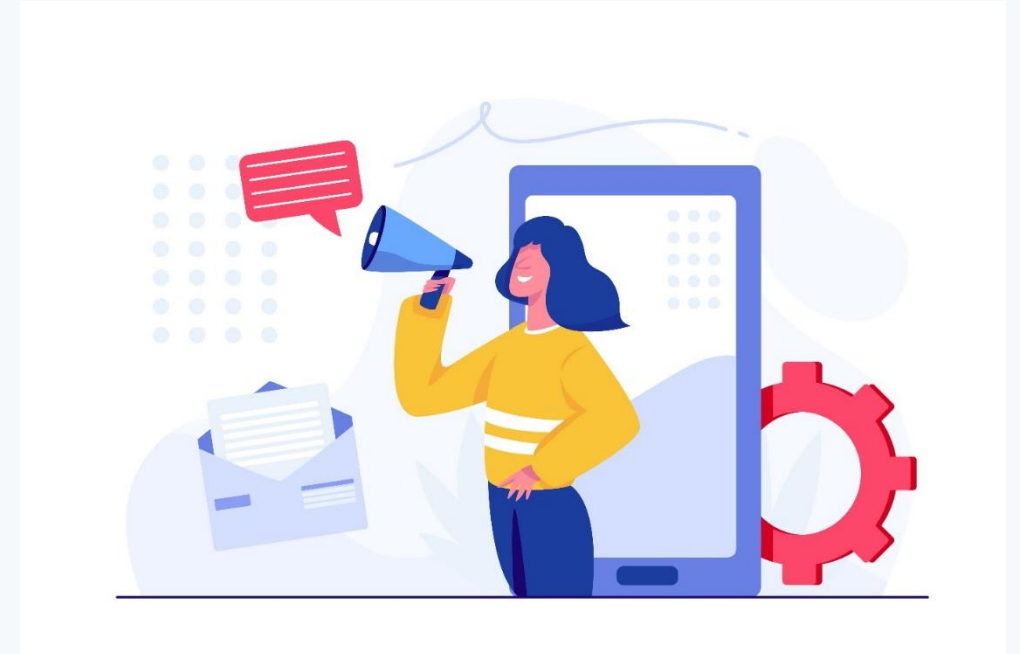
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## 3. EFFECTIVE LEADERSHIP

### 3.10. EFFECTIVE COMMUNICATION SKILLS

- Leader must be an excellent communicator
- Effective communication skills for great leaders:
  - Be Understood By Others,
  - Build Trust,
  - Be Active Listener,
  - Communicate Clearly,
  - Be Able To Ask Questions,
  - Receive And Implement Feedback,
  - Communicate Transparent,
  - Teak Care On Body Language.



Source: <https://www.freepik.com>

### 3.11. TIME MANAGEMENT

- Effective time management leads to effective leaders
- Today – everyone is busy!

#### **Key areas of time for successful leaders:**

- Time To Listen (Practice One-on-one Meetings)
- Time To Reflect (Step Outside Day-to-day Work)
- Time To Develop (Planning The Growth)



Source: <https://pixabay.com>

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# Thank you



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# TU. 5 LU. 18

**TRAINING UNIT 5 - COMPANY CULTURE**

**LEARNING UNIT 18 - INTERCULTURAL MEDIATION**

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## FUNDING

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## 1. Introduction to intercultural mediation

## 2. Culture

- 2.1. What is culture?
- 2.2. The Concept of Culture
- 2.3. An iceberg

## 2. Culture

- 3.1. What does intercultural mediation mean?
- 3.2. Intercultural competence
- 3.3. Intercultural mediator

## 3. Geert Hofstede's six-dimension model

## 4. The conflict management styles of Thomas Killman.

## 5. If you want to explore more



Source: <https://akgtcanada.com/if-i-really-knew-you/>

# 1. INTRODUCTION TO INTERCULTURAL MEDIATION



In this module, you will become familiar with the concept of culture and its layers. You will explore different models of culture such as the model of the onion and the model of iceberg.

The main aim of this unit is to define culture and intercultural mediation without stigmatizing or caricaturing by acquiring Hofstede model. You will learn how to understand people from different cultures through the Hofstede model and how it is possible to turn intercultural misunderstandings towards better cooperation with respect so that a learner will be more intercultural in his/her approach.

By the end of this module you will know the different styles of conflict management that can be applied in the intercultural environment and you will be more able to interpret how others react on cultural differences and how to interact with these differences.

## 2. CULTURE

### 2.1. WHAT IS CULTURE?

Culture is the characteristics and knowledge of a particular group of people, encompassing language, religion, cuisine, social habits, music and arts. <https://www.livescience.com/21478-what-is-culture-definition-of-culture.html>

Culture refers to the cumulative deposit of knowledge, experience, beliefs, values, attitudes, meanings, hierarchies, religion, notions of time, roles, spatial relations, concepts of the universe, and material objects and possessions acquired by a group of people in the course of generations through individual and group striving. <https://people.tamu.edu/~i-choudhury/culture.html>



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## 2. CULTURE

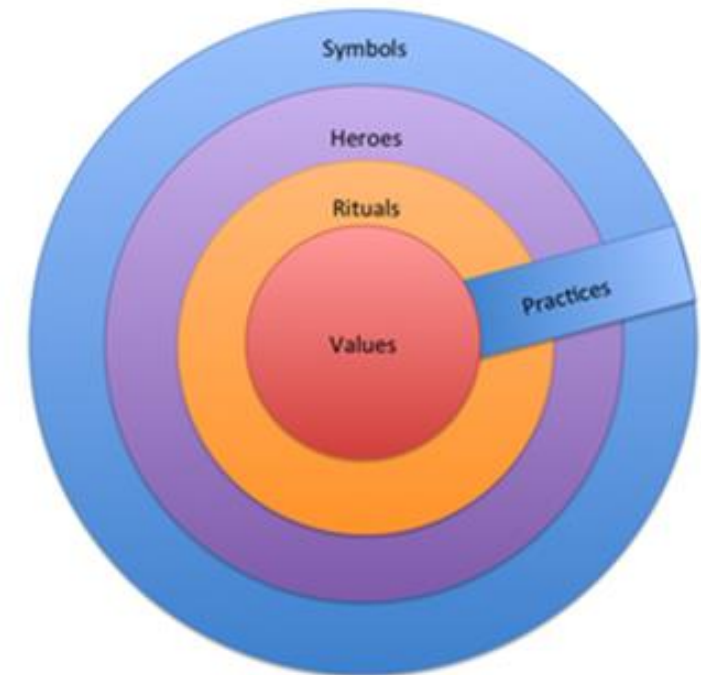
### 2.2. THE CONCEPT OF CULTURE

The concept of culture can be visualized as a number of layers.

The outer layers represent cultural artefacts or symbols such as flags, architecture, language or tradition. It is the tangible layer, the things a foreigner notices when he/she first comes to the country.

The next layer consists of the norms and values of culture. This could include how people greet each other, practice their religion, how they deal with time.

In the center are the basic values and cultural assumptions which influence all of the other layers. These are abstract and invisible, and therefore very difficult for an outsider to recognize. Examples are beliefs, norms and attitudes. We learn them from an early age, how to express emotions, when to smile and when to cry.



Source: <https://unitedbycultureblog.wordpress.com/hofdstedes-onion>

## 2. CULTURE

### 2.3. AN ICEBERG

Another presentation of the culture is an iceberg. Icebergs peak over the water, revealing just a small portion of the total mass like a Culture. People at first see a small portion of a person's culture based on things such as clothing, appearance, speech, grooming, greeting rituals, music, arts, or dances but a cultural iceberg contains essential characteristics beneath the surface.

Under the water line there are many components of culturelike: the ideas, preferences and priorities that comprise individual attitudes and values.



### 3. INTERCULTURAL MEDIATION

#### 3.1. WHAT DOES INTERCULTURAL MEDIATION MEAN?

Intercultural mediation can be defined as a methodology which looks beyond the barriers of language, culture and politics in order to find a common understanding of the ethics and improve the ability of the manager to mediate both between colleagues and between his/her own cultural understanding and the understanding of other people.

Intercultural mediation can also be defined as cross-cultural conflict resolution.

Intercultural mediation involves a neutral facilitator to assist parties in resolving disputes impacted by cultural misunderstanding.

Intercultural mediation includes finding commonalities between working cultures in order to avoid conflict and promote integration and to develop links of sociability between people from different cultures.



Source: Image by pressfoto on Freepik



## 3. INTERCULTURAL MEDIATION

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Source: Photo by Philipp Potocnik on unsplash



### 3. INTERCULTURAL MEDIATION

#### 3.2. INTERCULTURAL COMPETENCE

Intercultural competence is defined by the ability to communicate successfully with people from other cultures. The basis for a successful intercultural communication lies in the emotional intelligence and intercultural sensitivity.



Source: Photo by Antenna on Unsplash

## 3. INTERCULTURAL MEDIATION

### 3.3. INTERCULTURAL MEDIATOR

**Intercultural mediators should have the ability:**

- To Create An Inclusive Learning/Working Environment Where Everybody Has The Right Of Self-expression And At The Same Time The Obligation To Respect Different Cultural Identities;
- To Promote Successful Communication/Collaboration Across Cultures;
- To Teach Dialogue Among Cultures;
- To Create The Conditions For Maintenance And Mutual Enrichment Of Cultural Identities.



Source: Photo by Cherrydeck on Unsplash

## 3. INTERCULTURAL MEDIATION

### 3.3. INTERCULTURAL MEDIATOR

**What are the main features of an effective intercultural mediator:**

- Mindful
- Adaptable
- Patient
- Objective
- Assertive



*Photo by Christina @ wocintechchat.com on Unsplash*



## 4. GEERT HOFSTEDE'S SIX-DIMENSION MODEL

Geert Hofstede's six dimension model provides a structure with which to understand and describe key differences in values between different cultures. Geert Hofstede, is a Dutch organizational psychologist who developed a survey by studying IBM employees in 40 different nations. From the survey, he derived four dimensions that he then used to categorize the 40 nations.

Now upwards of 100,000 people have taken his measure. It should be noted that his measures are intended to reflect each society as a whole; not individuals. His analysis is further hampered by the fact that the data that is used comes from those who take his analysis test. This means that it reflects mostly urban people engaged in the business world who have a vested interest in understanding the people from other nations that they will be doing business with.

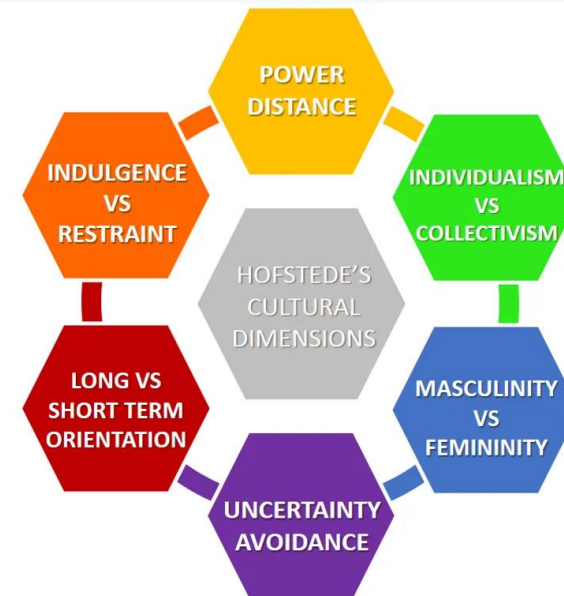


*Source: Photo by Jacek Dylag on Unsplash*

## 4. GEERT HOFSTEDE'S SIX-DIMENSION MODEL

By surveying 50 countries and three regions, he was able to identify differences in cultures in six primary dimensions:

- **Power distance**
- **Individualism versus collectivism**
- **Uncertainty avoidance**
- **Masculinity versus femininity**
- **Long-term versus short-term orientation**
- **INDULGENCE VERSUS RESTRAINT**



Source: <https://i0.wp.com/www.business-to-you.com/wp-content/uploads/2017/04/Hofstedes-Cultural-Dimensions.png>

# 4. GEERT HOFSTEDE'S SIX-DIMENSION MODEL

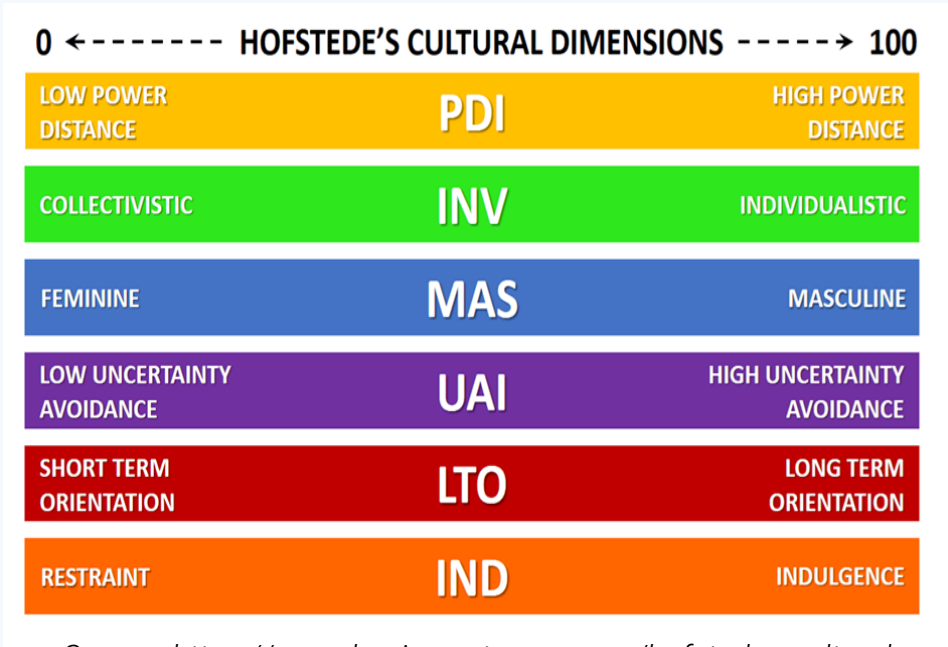
The cultural dimensions represent independent preferences for one state of affairs over another that distinguish countries (rather than individuals) from each other.

Different cultures were evaluated to determine where they are on the spectrum (between high and low ) of each dimension.

Each dimension has been derived by comparing many, but not all, countries in the world.

The model does not imply that everyone in a given society is programmed in the same way; there are considerable differences between individuals.

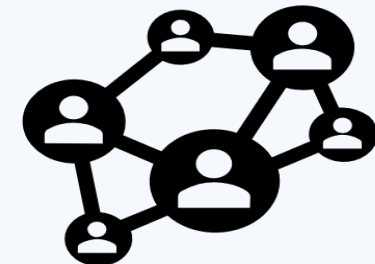
The country scores on the dimensions are relative, in that we are all human and simultaneously we are all unique. In other words, culture can only be used meaningfully by comparison.



Source: <https://www.business-to-you.com/hofstedes-cultural-dimensions/>

## 4. GEERT HOFSTEDE'S SIX-DIMENSION MODEL

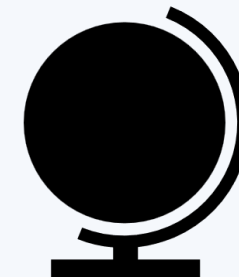
- **Power distance:** This dimension expresses the degree to which the less powerful members of a society accept and expect that power is distributed unequally. The fundamental issue here is how a society handles inequalities among people. People in societies exhibiting a large degree of Power Distance accept a hierarchical order in which everybody has a place and which needs no further justification. In societies with low Power Distance, people strive to equalise the distribution of power and demand justification for inequalities of power.
- **Individualism versus collectivism:** is about the relative importance of individual versus group interests. Individualism can be defined as a preference for a loosely-knit social framework in which individuals are expected to take care of only themselves and their immediate families. Collectivism represents a preference for a tightly-knit framework in society in which individuals can expect their relatives or members of a particular ingroup to look after them in exchange for unquestioning loyalty. A society's position on this dimension is reflected in whether people's self-image is defined in terms of "I" or "we."





## 4. GEERT HOFSTEDE'S SIX-DIMENSION MODEL

- **Uncertainty avoidance:** The Uncertainty Avoidance (UA) dimension expresses the degree to which the members of a society feel uncomfortable with uncertainty and ambiguity. The fundamental issue here is how a society deals with the fact that the future can never be known: should we try to control the future or just let it happen?
  - Countries exhibiting strong UA maintain rigid codes of belief and behaviour, and are intolerant of unorthodox behaviour and ideas. Low Uncertainty Avoidance societies maintain a more relaxed attitude in which practice counts more than principles. Countries exhibiting a high Uncertainty Avoidance maintain rigid codes of belief and behaviour and are intolerant of unorthodox behaviour and ideas. These countries often need many rules to constrain uncertainty.
  - Countries with a low Uncertainty Avoidance index maintain a more relaxed attitude, tolerance for ambiguity is accepted and the need for rules to constrain uncertainty is minimal.



## 4. GEERT HOFSTEDE'S SIX-DIMENSION MODEL

- **Masculinity versus femininity:** The masculinity side of this dimension represents a preference in society for achievement, heroism, assertiveness, and material rewards for success. Society at large is more competitive. Its opposite, femininity, stands for a preference for cooperation, modesty, caring for the weak and quality of life. Society at large is more consensus-oriented.

In the business context Masculinity versus Femininity is sometimes also related to as “tough versus tender” cultures.



## 4. GEERT HOFSTEDE'S SIX-DIMENSION MODEL

- **Long-term versus short-term orientation:** Every society has to maintain some links with its own past while dealing with the challenges of the present and the future.

Societies prioritize these two existential goals differently.

Societies who score low on this dimension, for example, prefer to maintain traditions and norms while viewing societal change with suspicion. Those with a culture which scores high, on the other hand, take a more pragmatic approach: they encourage thrift and efforts in modern education as a way to prepare for the future.

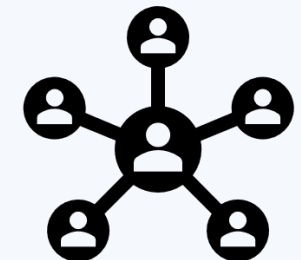
In the business context, this dimension is referred to as “(short-term) normative versus (long-term) pragmatic” (PRA). In the academic environment, the terminology Monumentalism versus Flexhumility is sometimes also used.



## 4. GEERT HOFSTEDE'S SIX-DIMENSION MODEL

- **INDULGENCE VERSUS RESTRAINT:** Indulgence stands for a society that allows relatively free gratification of basic and natural human drives related to enjoying life and having fun. Restraint stands for a society that suppresses gratification of needs and regulates it by means of strict social norms. This dimension is defined as the extent to which people try to control their desires and impulses, based on the way they were raised.

Relatively weak control is called Indulgence and relatively strong control is called Restraint. Cultures can, therefore, be described as Indulgent or Restrained. Indulgence stands for a society that allows relatively free gratification of basic and natural human drives related to enjoying life and having fun. Restraint stands for a society that suppresses gratification of needs and regulates it by means of strict social norms.



## 5. THE CONFLICT MANAGEMENT STYLES OF THOMAS KILLMAN

There are several styles that can be used for conflict management. They would work also for intercultural mediation.

Different people respond differently to conflicts. There are two approaches of dealing with the situation of conflict - assertive in their approach or cooperative.

**Assertiveness** is the how much a person chooses to satisfy their own needs.

**Comparativeness** is how much a person chooses to satisfy the other person's needs.



Source: <https://managementweekly.org/thomas-kilman-conflict-resolution-model/>

## 5. THE CONFLICT MANAGEMENT STYLES OF THOMAS KILLMAN

The five styles for conflict management are the core takeaway from Thomas Kilmann's conflict model. These styles can be reflected in cultural styles of conflict management.

- **Avoidance:**

The avoiding style reflects passivity in conflict management. It is an approach when a person withhold his views and opinions and when the cost of confrontation and resolution is higher than the cost of living with the conflict. Unfortunately, avoiding does not resolve the conflict.

- **Competing:**

It means high assertiveness and low cooperation. In a situation of cultural dominance, you behave as if you were from your own cultural background. You assume that others adapt to it.



*Source: Photo by krakenimages on Unsplash*

## 5. THE CONFLICT MANAGEMENT STYLES OF THOMAS KILLMAN



- **Accommodating:**

Instead of doing what is self-evident from your own culture, you do your best to do what others do. It may be worthwhile in situations when the conflict is a total waste of your time.

- **'Compromise:**

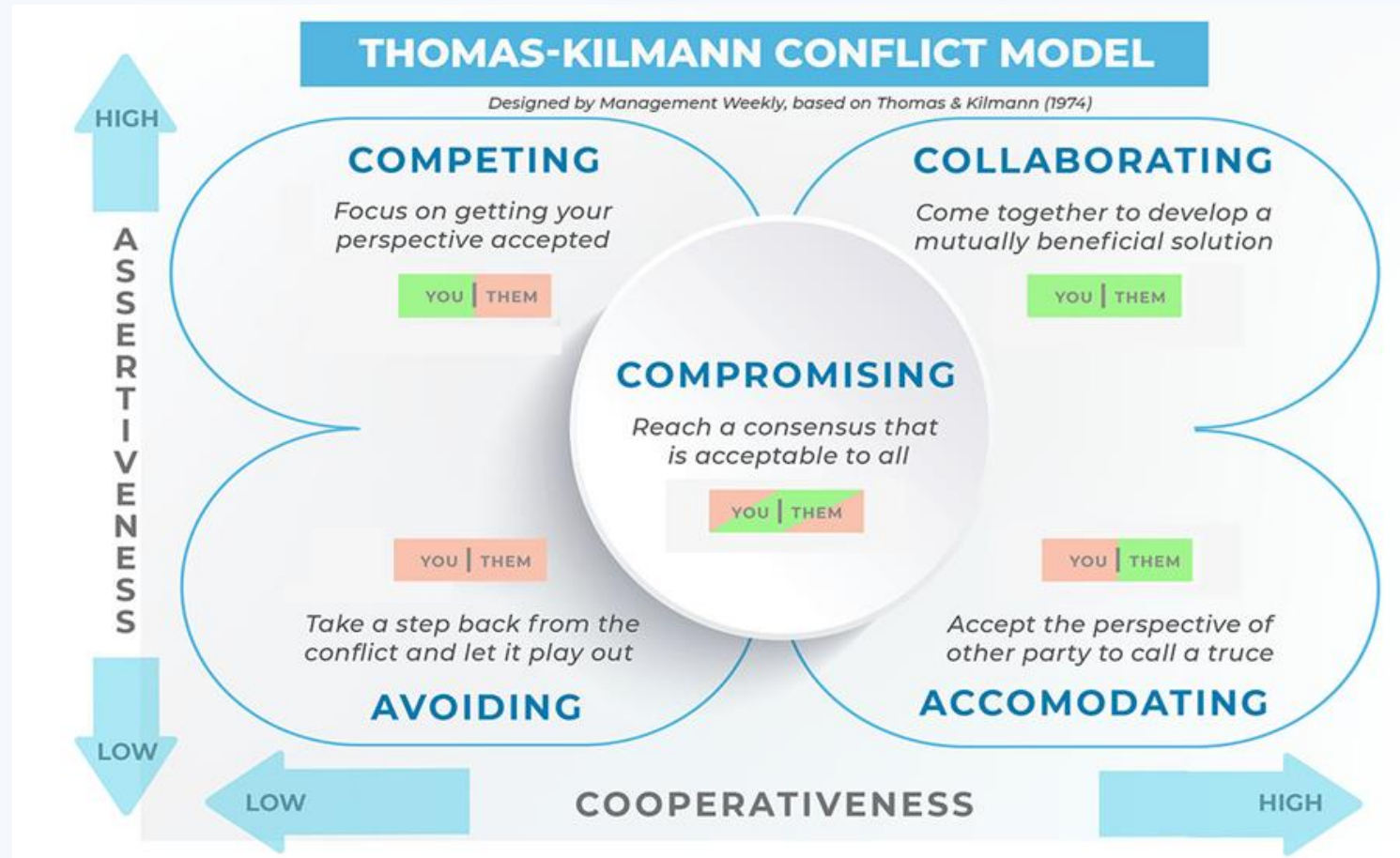
If you make a cultural compromise, you do half of what is normal from your own cultural background, and you also give up half of it. The other party also holds half and gives up half. Many people think that a compromise is a good thing. But a compromise also means that you leave a lot of possibilities untapped, because all parties are surrendering half of what they could possibly have fully invested.

- **Cultural synergy (collaborating):**

If you use the cultural-synergetic approach, you develop new ways of working. Forget about who has to adapt to whom. Forget who is the majority and who is the minority. You appreciate all cultures in making their own unique contributions to making work and life more creative and dynamic. So: we consider all cultural styles, communication and behaviour to be equally professional. You recognise cultural differences as sources of innovation and growth. Collaborating takes time. There are some conflicting situations where we know that the best potential solution would be to satisfy all the parties. In such situations, we typically approach the conflict as a compromise.



## 5. THE CONFLICT MANAGEMENT STYLES OF THOMAS KILLMAN



Source: <https://managementweekly.org/thomas-kilman-conflict-resolution-model/>

## 6. IF YOU WANT TO EXPLORE MORE

- Watch these videos about the cultural iceberg (introduction)
  - <https://www.youtube.com/watch?v=-mkeGtUD1zY>
  - <https://www.youtube.com/watch?v=woP0v-2nJCU&t=3s>
  - [https://www.youtube.com/watch?v=a9Z83I\\_g4Hw](https://www.youtube.com/watch?v=a9Z83I_g4Hw)
  
- Or these videos of Geert Hofstede:
  - 10 minutes with Geert Hofstede... on Power Distance <https://www.youtube.com/watch?v=DqAJclwfyCw>
  - 10 minutes with Geert Hofstede on Individualism versus Collectivism <https://www.youtube.com/watch?v=zQj1VPNPHII>
  
- Other resources suggested are:
  - Try our Country Comparison tool or compare your personal preferences to the scores of a country of your choice, with Culture Compass™ <https://www.hofstede-insights.com/models/national-culture/>
  - According to the Hofstede model, discover some dimensions per country. Use this link to help you: <https://www.hofstede-insights.com/country-comparison/>

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